GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

MODERNIZATION AWARDS
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Power

APRIL 1955 • 50¢
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SOUND PLANNING—the key to better layouts for engineering offices • p 111

NEWS! SELF-CLEARING ASH HANDLING SYSTEM

with 3 exclusive features!

What the jet plane did to the ox-cart, A-S-H has done to Pneumatic Ash Handling Systems. There's no clogging—no plugging—long wear—with the new Ceramic Throat, Improved Vacuum Breakers, Materials Handling Valves and other important features.

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Automatically operated Vacuum Breaker Valves assure a clean sweep of all risers in each dump cycle.

A-S-H Steam Jet Ash Handling Systems bring to the small boiler plant pneumatic ash handling at its best. Every A-S-H system is the product of long engineering experience, precise and practical design, skillful workmanship. For complete technical data on A-S-H Steam Jet Pneumatic Ash Handling Systems, send to Dept. A1 for Data Sheet Za.

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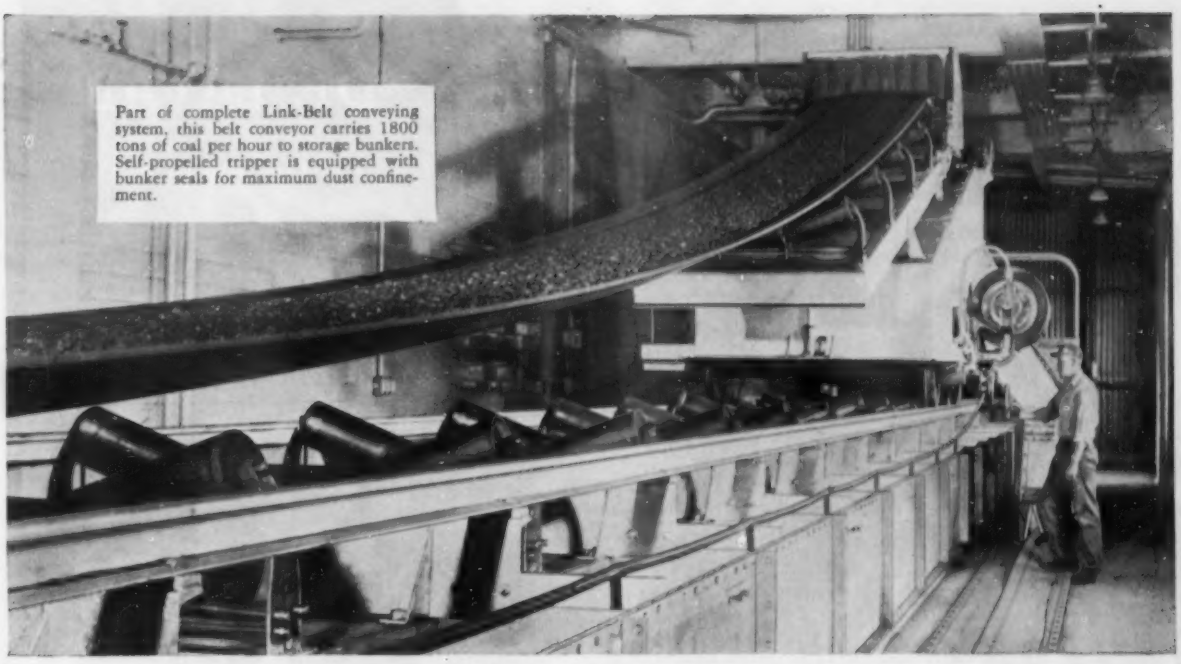

Part of complete Link-Belt conveying system, this belt conveyor carries 1800 tons of coal per hour to storage bunkers. Self-propelled tripper is equipped with bunker seals for maximum dust confinement.

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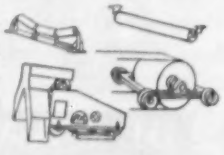

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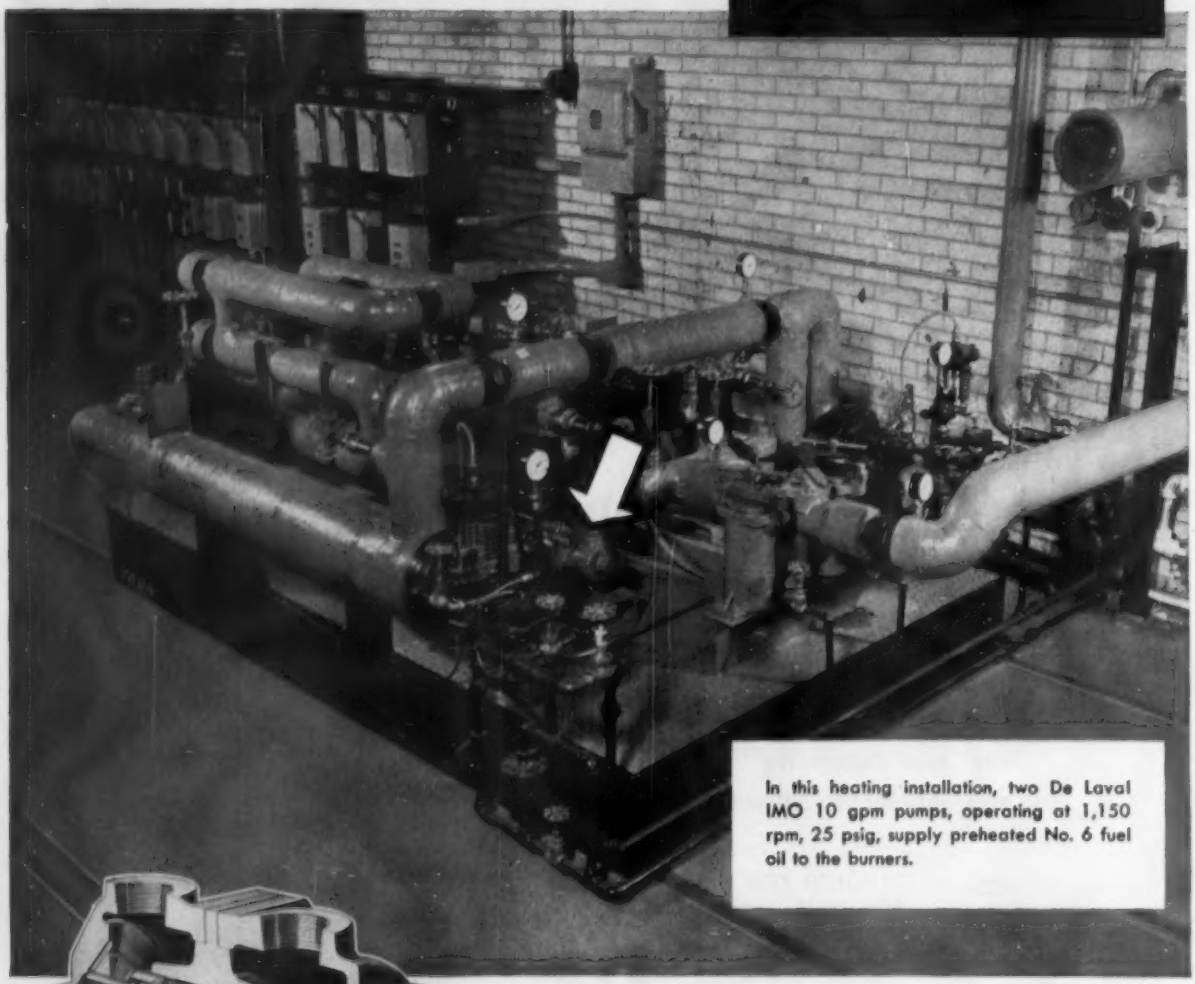
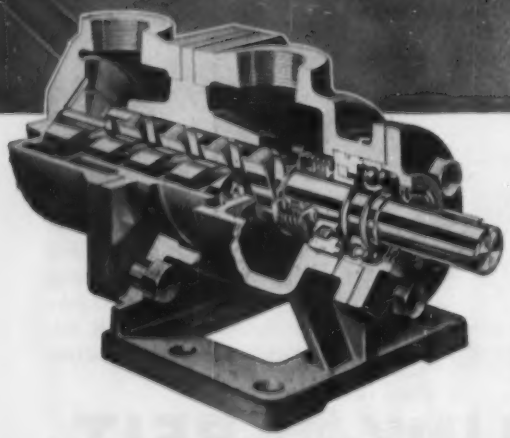
DE LAVAL

IMO PUMPS



In this heating installation, two De Laval IMO 10 gpm pumps, operating at 1,150 rpm, 25 psig, supply preheated No. 6 fuel oil to the burners.



A wide range of De Laval IMO models specifically built for fuel oil service is available. Capacities up to 80 gpm, pressures to 275 psig. Write today for Bulletin LG-A.

To increase your present—and future—profits on commercial heating jobs, install *dependable* De Laval IMO pumps on pump and heater sets. Their simple, trouble-free design saves you money on service calls . . . builds customer goodwill, for there's nothing to get out of order or need adjustment. No pilot gears, no sliding vanes, no reciprocating pistons. De Laval IMO's have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation.

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DE LAVAL STEAM TURBINE COMPANY

815 Nottingham Way, Trenton 2, New Jersey

DL-278

Power

APRIL 1955 • VOLUME 99 NUMBER 4

ENGINEERING AND MANAGEMENT

How to reduce piping cost with welding fittings and flanges 75
Screenless water intake proves troublefree 80
Nuclear notes: news of latest developments 82
New way to remove feedwater silica 83
How air-velocity control solves noise and dust problems 86
Nuclear power reactors and their parts: Study course No. 9 88
Latest practice in insulating semioutdoor boilers 92
Don't miss this chance to win recognition: 1955 awards 95
Makers boost IC ratings 50% on some low-voltage circuit breakers 96
How engineered modernizing cured this plant's ills 98
Mill burns refuse with spreader stokers 101
Get engineering ideas across to an audience—short and sweet 104
Data sheet: Economical high-temperature insulation 107

PLANT OPERATION AND MAINTENANCE

Office layout for engineers 111
Run these tests for flowmeter accuracy 114
Trouble-shooting some diesel operating faults 116
Top performance from your heat exchangers with backwashing 117
Pay close attention to feed regulators, heaters, evaporators 118
Modern turbine pump: operators' choice for specialized jobs 120
Let's get your air conditioning set for hot days ahead 124
New drive uses steel shot as "fluid" 127
Safety is your business 128
Don't overlook these handy electrical heating methods 130
Practical ideas 132
Plant problems 138
Arguments 144
How-to 146
Basics: No. 4 in a series 148
Marmaduke Surfaceblow 150

READER SERVICE SECTION

This month's service features 154
Reports from the field 156
Technical briefs 158
Plant equipment news 162
New free bulletins 171
George Edwards 174

Print order this issue: 47,308

APRIL 1955 POWER Vol 99—No. 4

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POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own annual index.

OFFICE PLANNING, a subject of vital importance to almost every engineer, is pictured on the cover. Shown are William Hammel and John Volk, project engineers, and R K Gad, Jr, Director of the Office Planning Div, Shaw-Walker Co, in the early stages of planning the new Atlas Powder Co office building. These men prepared the original layouts and sketches, which are now being followed in construction of the building.

Mr Gad's article, pp 111-113, should ring the bell with every engineer who has fussed with desk, drawing board, file, accounting and instrument-board layouts. Good efficiency in the office is almost certain to be reflected in better production throughout the plant.

Next month . . .

■ Selection of mechanical-draft fans, often a complex engineering problem, is the subject of a comprehensive article in May. Items discussed include duct pressure loss, system costs, economics, controls and analysis of fan and duct designs in the plant.

■ Diagnosing, overhauling and maintaining barrel-type boiler-feed pumps will be covered from two angles in May—the first is from the engineering standpoint, showing how to determine when an overhaul is needed. Second, an 8-pager, shows how to perform every step in an actual overhaul.

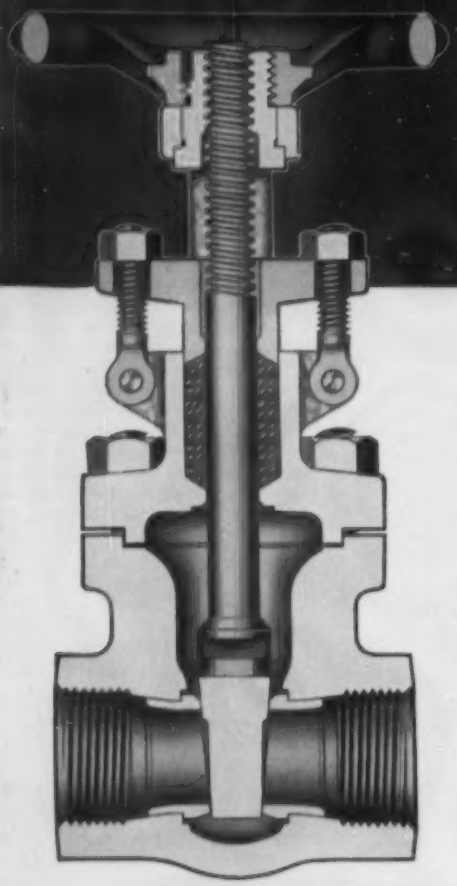
■ Isometrics in engineering—how they are used in actual working drawings—is a May article that should interest many readers in the power field.

■ An experience story on mono-bed demineralization—how it solved a severe silica-fouling problem in a high-makeup high-pressure station. If feedwater interests you at all, don't miss this May story, giving much helpful info.

. . . and future months

■ In the works right now are plans and layouts for next December's special report. Dealing with a subject of major interest to every power engineer and plant manager, it should go a long way toward making their jobs easier. Watch for details in future issues of POWER.

You get Big Valve quality in these SMALL 600-POUND STEEL GATES by CRANE



BOLTED BONNET OR UNION BONNET

In the cross-section of the bolted bonnet pattern above, you can see the rugged *big-valve* construction. Bolted bonnet valves available in sizes ½ to 2-inch—union bonnet valves in sizes ¼ to 2-inch.

Screwed Ends—Union Bonnet or Bolted Bonnet

Socket-Welding Ends—Bolted Bonnet or Union Bonnet

Flanged Ends—Bolted Bonnet only

Look no further for dependable steel valves in sizes up to 2-inch. Whether you prefer the union bonnet or bolted bonnet pattern, you get refinements usually found only in larger, more expensive valves.

For example, you get a compact, weight-saving structure of high-quality carbon steel. Smooth operation and positive closure of the solid wedge disc are assured by a T-head disc-stem connection and full-length machined guide ribs. There's also an unusually large stuffing box filled with high-grade packing, a leakproof bonnet joint with retained gasket, a husky stem with outside threads, and many others. To simplify maintenance, Crane design includes swinging gland eye-bolts—plus a wide yoke with liberal working space around the gland.

USER'S CHOICE OF TRIM

There's versatility to these quality Crane steel valves, too. You can have your choice of trim to suit your service—Class X Trim (Exelloy body and body seat rings) for oil or oil vapor—Class XW Trim (Exelloy seat rings, disc of hardened stainless steel) for steam or water. Union bonnet valves also available with Class L Trim (18-8 Mo Alloy seats, disc, stem) for liquids and gases up to 750° F.

Full details in 6-page folder AD-1881. Ask your Crane Representative next time he calls, or write direct.

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...with Power readers...

DIESEL TROUBLES

In your January issue I see an article by Rick Denning, "Spot your diesel troubles in a hurry." But what I see is the first part of a list of 15 troubles with 2 to 16 causes, an average of 11.

A list like this makes one realize how difficult it is to diagnose troubles with conventional tabulations. Only when several symptoms are combined is the possible source of trouble narrowed down to a few, or one. This function is usually performed by the mind of an experienced man.

Of course it can be performed by a mechanism like the *Diesel Trouble Spotter*.

State College, Pa. P H SCHWEITZER

EDITOR'S NOTE: *The "Spotter" is a handy sliderule-like device and accompanying guide booklet that can be a big help when you have a sick engine on your hands. But Denning's check chart has its place too—as a quick review of typical troubles and their usual symptoms.*

SELECTING PERSONNEL

I am interested in securing information relative to tests and testing for power-plant personnel, as covered in the article by

(*Continued on page 226*)

...lines and bylines

R K Gad Jr

ENGINEERING OFFICES, p 111, are but one of the many interests of R K Gad Jr, director of the Office Planning Div, Shaw-Walker Co. Bob says nearly everyone who works in an office regards himself as a layout expert. He considers this as fallacious as trying to assume the job of an electrical engineer because you use electricity.

A planning consultant since 1946, Gad served as a specialist in marine operation and construction during World War II. Before that he was affiliated with the Fairchild interests, both as secretary to Fairchild and as methods consultant on reorganization. Layout work in recent years includes remodeling the Bridgeport Brass Co home office, plans for the new Atlas Powder Co offices and preparation of the entire floor plans for the RCA office and lab project at Cherry Hill, N. J.

Bob's hobbies include ocean sailing, polo and fox hunting. He has designed a number of offshore motor sailers. A member of the Caterpillar Club, he also has belonged to various yacht clubs.

M W Benjamin

OUTSTANDING PERFORMANCE keynotes the career of Max W Benjamin, president, Boddy, Benjamin and Woodhouse, Inc. They served as consultants to Motor Products Corp job that copped a POWER Modernization Citation, p 98.

A 1926 ME graduate of University of Michigan, he is a member of ASME, NSPE, Engrg Society of Detroit, Tau Beta Pi. Previous experience includes work as head of the steam power dept of a consulting firm, steam power engineer for a utility, thermo instructor, maintenance foreman and mechanical engineer for a pump manufacturer. In a consulting capacity, Benjamin has a long list of projects to his credit.

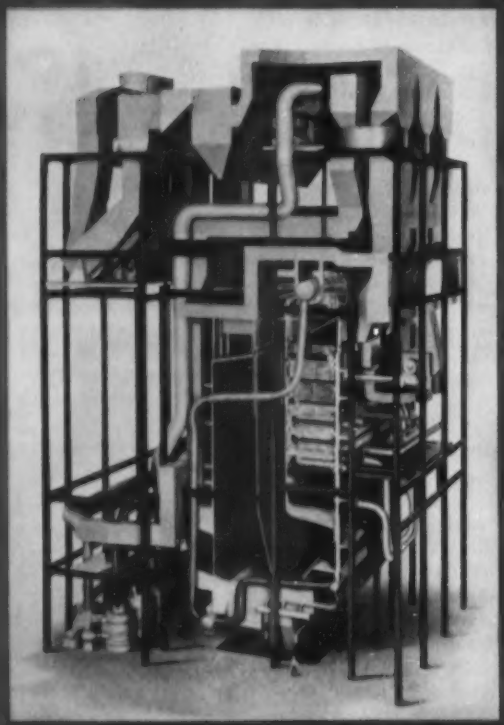
Special power-plant work covers heat-balance studies, electrical interconnection surveys, waste-fuel use, special piping design, and Chairman ASME Power Test Code Committee No. 4 on steam generators. He is the author of a number of technical articles.

E L Abramson

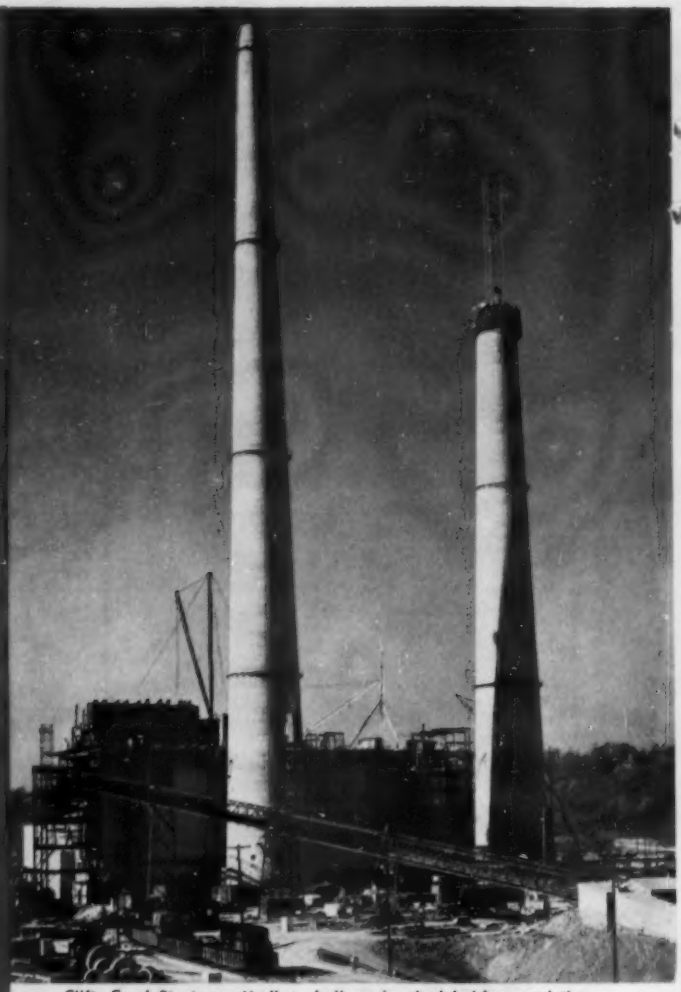
TURBINE PUMPS, p 120, have been E L Abramson's work the past 26 years. A Purdue ME graduate, he spent six years as test engineer on truck frames and bolsters. In 1929, he joined Westco Pump Corp as turbine-pump development engineer. Many of their units being used today saw their first light under his guidance.

In 1937, American-Marsh Pumps, Inc, asked him to develop a line of turbine pumps. From 1938 to 1942, Abramson designed and developed turbine pumps for Dayton-Down Co. Next he spent two years with Sta-Rite, Inc, doing the same work. While there he developed a line of turbine pumps for Worthington Corp. After five years with Roy E Roth Co, Abramson joined Aurora Pump Co. Hobbies include (via television) football, baseball, basketball and boxing.

11 B&W Boilers help OVEC supply 15 BILLION KWHRS OF POWER FOR ATOMS



Eleven B&W Boilers of the type shown here will generate steam at the two new plants which will supply all electricity required for the great atomic production center known as the Portsmouth Area Project. It is the largest and perhaps most significant single undertaking in the history of the electric utility industry.

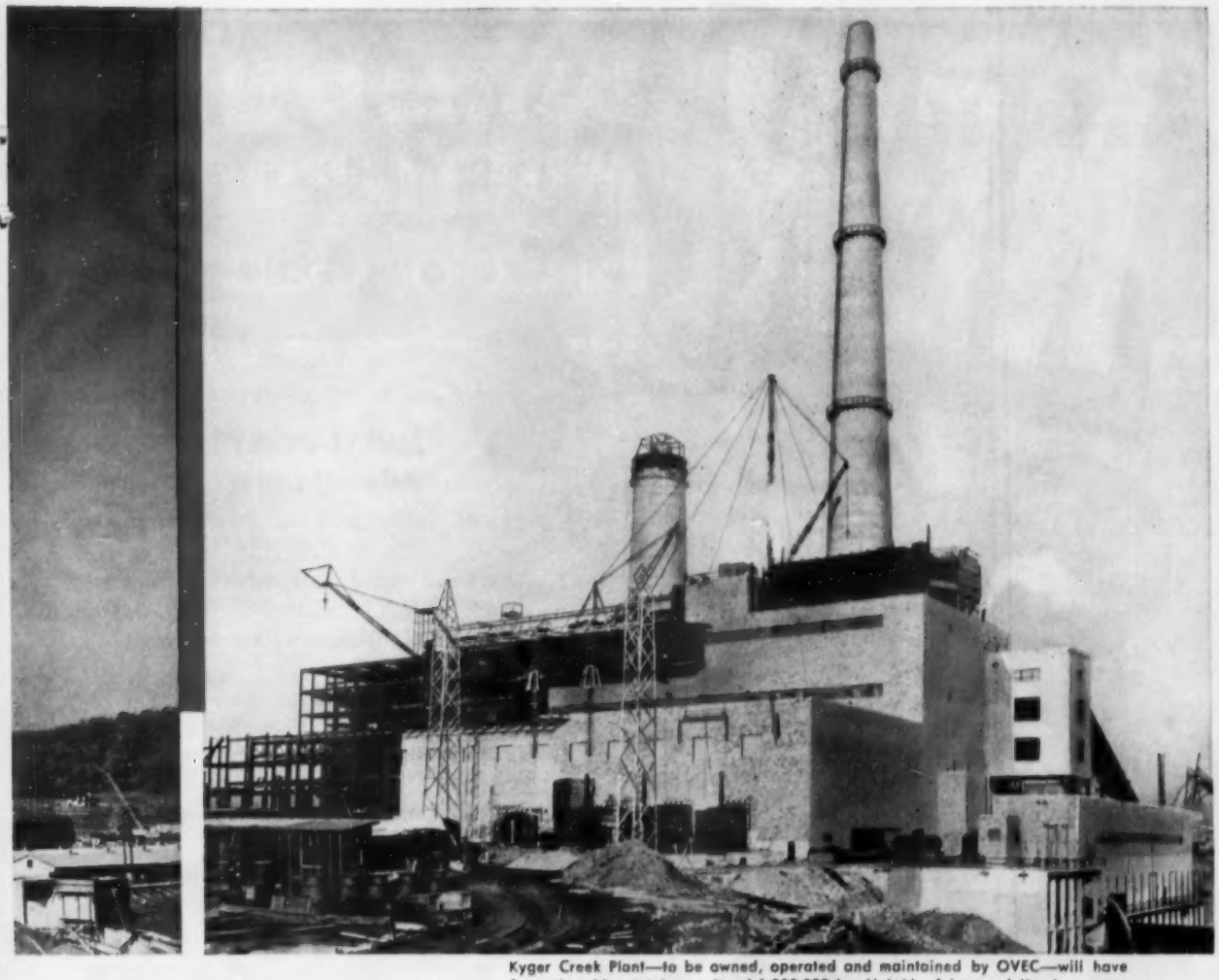


Clifty Creek Plant near Madison, Indiana, is scheduled for completion by the Spring of 1956. Unit No. 1 began delivering power in late January 1955. The Clifty Creek Plant will be owned, operated and maintained by IKEC. Its six units will have a total capacity of 1,200,000 kw—20 per cent larger than the Kyger Creek Plant. American Gas and Electric Service Corp. is the plant design engineer.

Once again America's private electric companies have demonstrated their resourcefulness. By combining their knowledge, skills and resources, 15 prominent utilities have accomplished a job of tremendous proportions quickly and efficiently—a job which would have been too big for any one company to handle.

By next year, two new power plants—now under construction as a result of cooperative planning by the 15 companies comprising Ohio Valley Electric Corp. and its subsidiary, Indiana-Kentucky Electric Corp.†—will be ready to supply more than the 15-billion kilowatt-hours of energy annually required for the process of uranium diffusion at the new Portsmouth Area Project. This huge block of power is greater than that used by New York City and is almost half as much electricity as is produced in all of France.

A number of factors relating to fuel, transportation and transmission were responsible for the choice of sites—both on the Ohio River—for the two power plants needed to meet this great demand. Now par-



Kyger Creek Plant—to be owned, operated and maintained by OVEC—will have five units with a total capacity of 1,000,000 kw. Unit No. 1 began delivering power in late January 1955, a full month ahead of schedule. The last unit is scheduled for completion by early 1956. Sargent & Lundy of Chicago is the design engineer.

tially completed, Kyger Creek and Clifty Creek plants will eventually have a combined capacity of 2,200,000 kw, and while Clifty Creek will be larger, the two plants will be similar.

Kyger Creek's five B&W Open-Pass Boilers will each produce 1,330,000 lb of steam per hr at 2000 psi and 1050 F, with reheat to 1050 F, and six B&W Boilers of the same type and size will furnish steam for kilowatts at Clifty Creek. The utilization of high temperatures, high pressures and reheat at both plants will place them among the most efficient and economical in operation. Together with a comparatively low fuel cost, this high efficiency rate will hold down the ultimate cost of the power produced there.

The choice of B&W Boilers and allied equipment for a project of this importance is an expression of confidence in B&W's contributions to efficient steam generation through intensive research and development covering nearly a century. We will be glad to discuss your boiler needs at your convenience.

†Appalachian Electric Power Company* • The Cincinnati Gas & Electric Company • Columbus and Southern Ohio Electric Company • The Dayton Power and Light Company • Indiana & Michigan Electric Company* • Kentucky Utilities Company • Louisville Gas and Electric Company • Monongahela Power Company** • Ohio Edison Company • The Ohio Power Company* • Pennsylvania Power Company*** • The Potomac Edison Company** • Southern Indiana Gas and Electric Company • The Toledo Edison Company • West Penn Power Company**

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The Babcock & Wilcox Company, Boiler Division,
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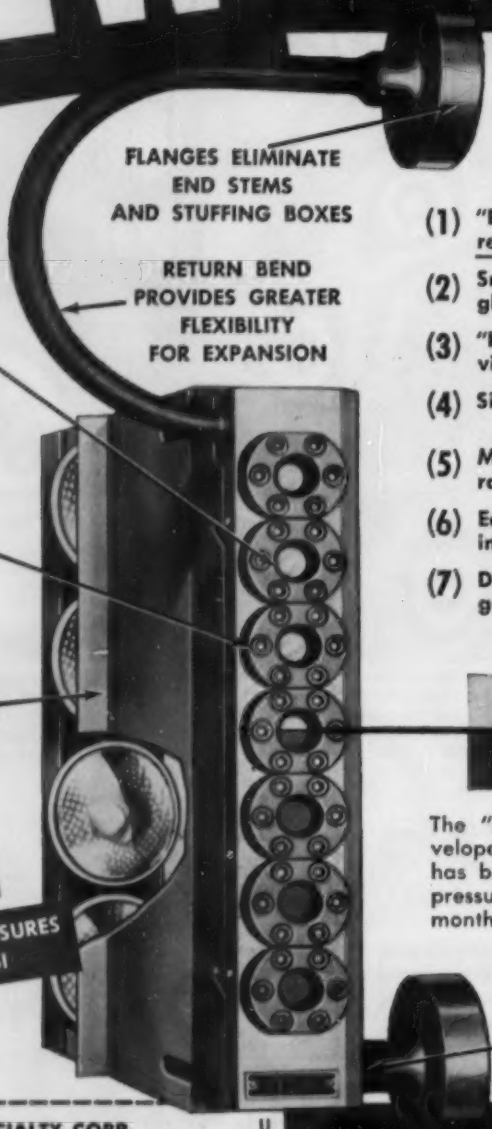
G-705

NEW DIAMOND "MULTI-PORT"® Bi-Color Gauge



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(3) "Hi-Lite" Illuminator for improved visibility

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(7) Direct reading . . . basic reference gauge

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WATER SHOWS GREEN

The "Multi-Port" gauge has been developed over a four-year period and has been in continuous successful high pressure operation for more than 18 months in several leading central station plants. For additional information, write for new Bulletin 1174 . . . use the coupon below.

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Please send me without obligation a copy of new Bulletin No. 1174 explaining the advantages of the Diamond "MULTI-PORT" Bi-Color Gauge.

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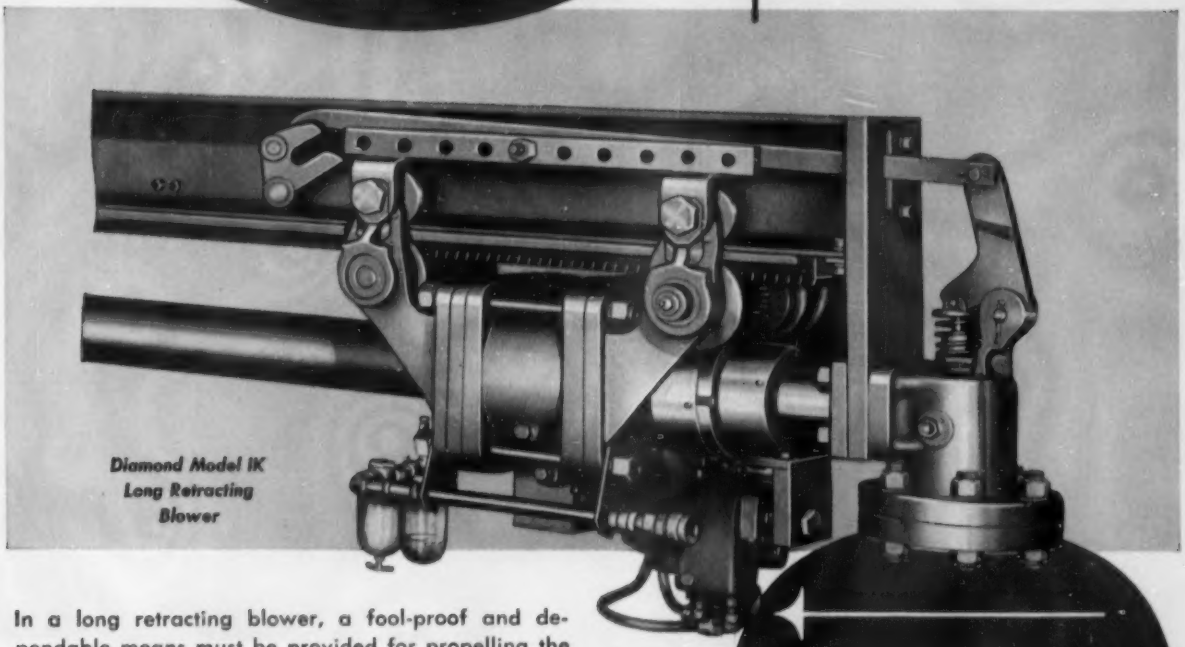
One of a Series

Reasons Why DIAMOND BLOWERS Assure CLEANER BOILERS *at LOWER COST*

SINGLE MOTOR DRIVE



Diamond Model IK Long Retracting Blower

A Single Motor (air or electric) Both Rotates and Propels the Long Lance Tube

In a long retracting blower, a fool-proof and dependable means must be provided for propelling the carriage and rotating the lance tube. In Model IK it is done with a SINGLE MOTOR working through a simple system of rugged gears. The operating mechanism is a model of simplicity and reliability . . . only one set of motor elements, one set of control elements . . . one set of power supply facilities to operate and maintain. This drive produces a closely pitched helical cleaning pattern which is most effective for *all* deposits and tube banks . . . without tube cutting.

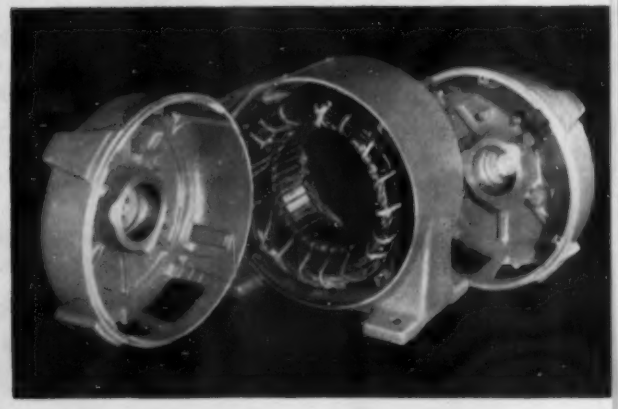
Other features which users approve with enthusiasm are the mechanically operated valve with adjustable pressure control, and the positive gear drive. Ask for Bulletin 1080U.

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited, Windsor, Ontario

6776

Diamond Model IK Long Retracting Blower. See its many features in Bulletin 1080.

MOTOR FACTS ON INDUSTRY'S
MOST-PREFERRED "POWER PACKAGE."



Electrical System Fact: New fortified insulation includes exclusive Bondar, Bondite and Mylar* for greater protection against the toughest operating conditions.

*Du Pont registered trade-mark

FACT:

The new Life-Line A has stronger insulation than any other motor on the market

Meaning what? Simply that the new Westinghouse Life-Line® "A" motor with new fortified insulation can withstand heavier overloads and operate at higher temperatures than any other motor you can buy.

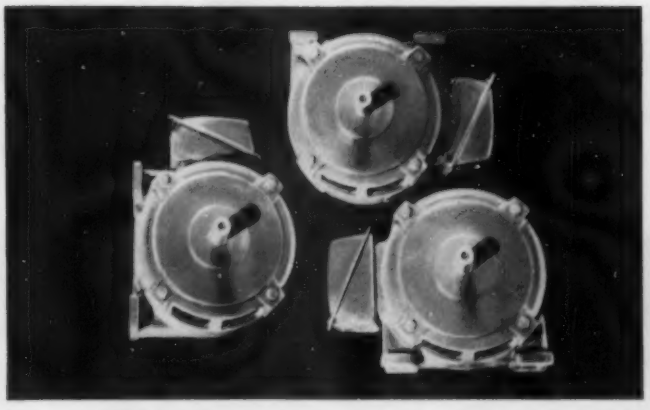
Similar design advances in the mechanical and lubrication systems make Life-Line "A" industry's most preferred motor.

It takes the right combination of *all three systems*—electrical, mechanical and lubrication—to build the best package of power on the market.

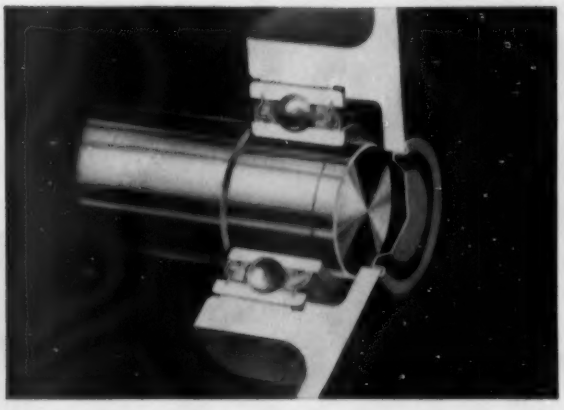
Get all the facts by calling your Westinghouse sales engineer . . . *The Man With The Facts!*

J-21877

YOU CAN BE SURE...IF IT'S Westinghouse



Mechanical System Fact: New cast-iron housing on both drip-proof and totally-enclosed types. Ventilation openings only in end brackets make the motor drip-proof whether mounted on floor, ceiling or wall.



Lubrication System Fact: New "4-way sealed", pre-lubricated bearing eliminates completely the 3 main causes of bearing failure: 1) contamination, 2) over greasing, 3) wrong grease.

Here is the New Bailey

The New Bailey Recorder provides continuous chart records of any four measured variables:

% combustibles	density	flow	pH	ratio	speed
combustion	differential	liquid level	position	smoke density	temperature
conductivity	draft	% oxygen	pressure	specific gravity	vacuum

Recorder for—

Pneumatic and Electric Transmission Systems

Here is a panel-mounted recorder that offers new versatility never before available in a single instrument. Its unique interchangeable-unit design permits recording up to four measured variables, regardless of their nature or the location at which they are measured.

Individual plug-in type pneumatic or electronic receivers—and corresponding integrators—are interchangeable in the four identical frame-slots, permitting any combination of four pneumatic or electronic signal receivers, *or any two receivers and their two integrators.*

For the first time you can record four telemetered measurements on a single 12-inch circular chart—with a minimum of first cost and installation expense, and a maximum of operating economy. Low cost multi-purpose components permit fast and easy adaptation to new or changed process cycles.

Check These Outstanding Advantages

Extreme Flexibility of Application is provided through the use of pre-calibrated plug-in type units—pneumatic or electronic—to record any measurable variables, in any combination. For example, you can "plug-in" pneumatic receivers along with electronic receivers to record up to a total of four variables on the same chart. Or your recorder casing can accommodate two integrators and their two corresponding recording receivers for rate of flow.

Faster, Easier Servicing of instruments is possible because of the new, sealed ink sacs and capillary pens. Under normal conditions ink sacs need be replaced only once each year. There is no day-to-day inking of pens.

Faster, Easier Ordering from Stock results from the unique standardized unit design. You can select any combination of recording receivers to fit your needs, by reference to simplified catalog specifications, and receive shipment without the delays ordinarily resulting from custom assembly. Complete interchangeability of plug-in type components simplifies stocking of spare units.

G34 2

Plug-in type pneumatic receiver

Plug-in type integrator

Plug-in type electronic receiver

Write for complete specifications—use handy coupon below

BAILEY
METER COMPANY
1036 IVANHOE ROAD
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Controls for Power and Process

BAILEY METERS

COMBUSTION
TEMPERATURE
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LEVEL
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Bailey Meter Company
1036 Ivanhoe Rd., Cleveland 10, Ohio
Please send me product specifications on the new Bailey Recorder, as follows:

☐ With Pneumatic Receivers—Spec. P11-5
☐ With Electronic and Pneumatic Receivers —Spec. E12-5

Name_____
Title_____
Company_____
Street and Number_____
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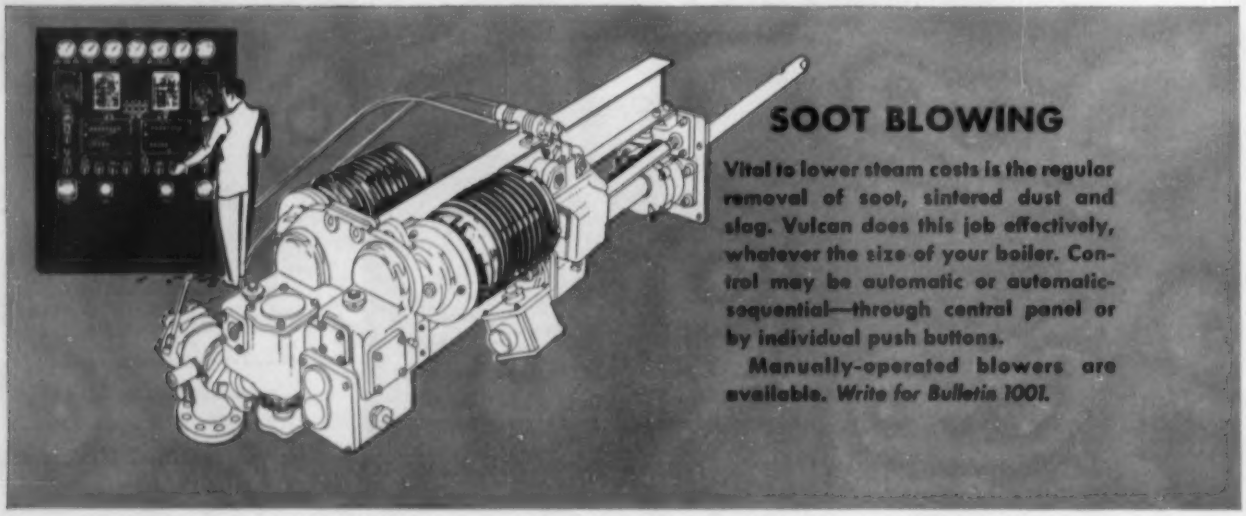
COPES
VULCAN
offers
COMBUSTION CONTROL
You can save fuel, labor and maintenance dollars by installing modern Copes-Vulcan combustion control.
You can be sure of:
—highest combustion efficiency
—constant furnace pressure
—constant steam pressure and temperature
Bulletin 1007-A describes this new approach to boiler control through
C·V+T=BBC
COPES·VULCAN+Taylor=BETTER BOILER CONTROL

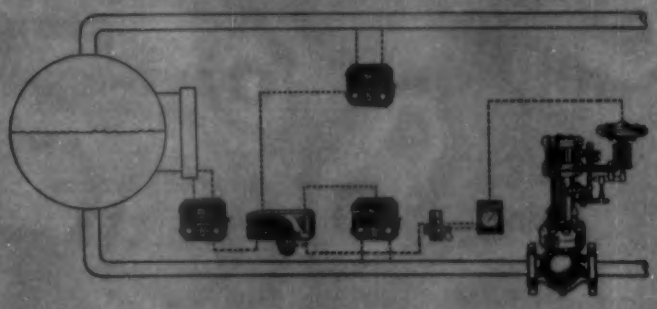
Reduce your steam costs. Get more efficient and safer boiler operation. Use one or more of these four Copes-Vulcan aids to offset rising costs of fuel, labor and maintenance. C • V + T offers a new approach to boiler control—with undivided responsibility from analysis to installation—and service wherever needed for the life of the installation.


SOOT BLOWING
Vital to lower steam costs is the regular removal of soot, sintered dust and slag. Vulcan does this job effectively, whatever the size of your boiler. Control may be automatic or automatic-sequential—through central panel or by individual push buttons.
Manually-operated blowers are available. Write for Bulletin 1001.

4 aids to lower steam costs

FEED WATER CONTROL

Copes feeds exactly as needed to maintain correct water level while meeting steam demands. Three-, two- or one-influence systems are available for your specific needs. Control may be independent, or tied in with combustion control. Take a look at the newest three-influence COPES instrument-type feed water control system—Type 3-L, described in *Bulletin 1013.*

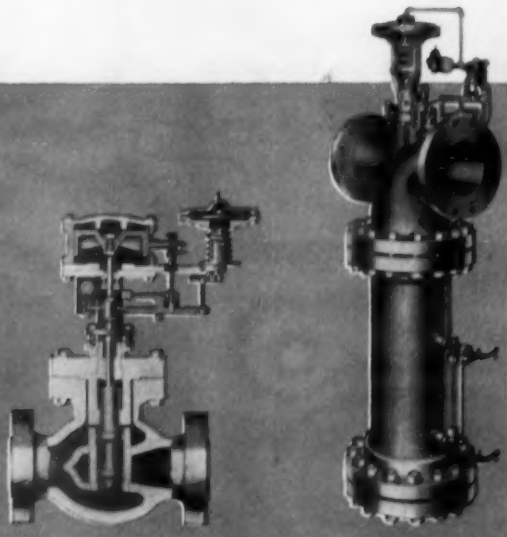


COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE 4, PENNSYLVANIA

REDUCING and DESUPERHEATING

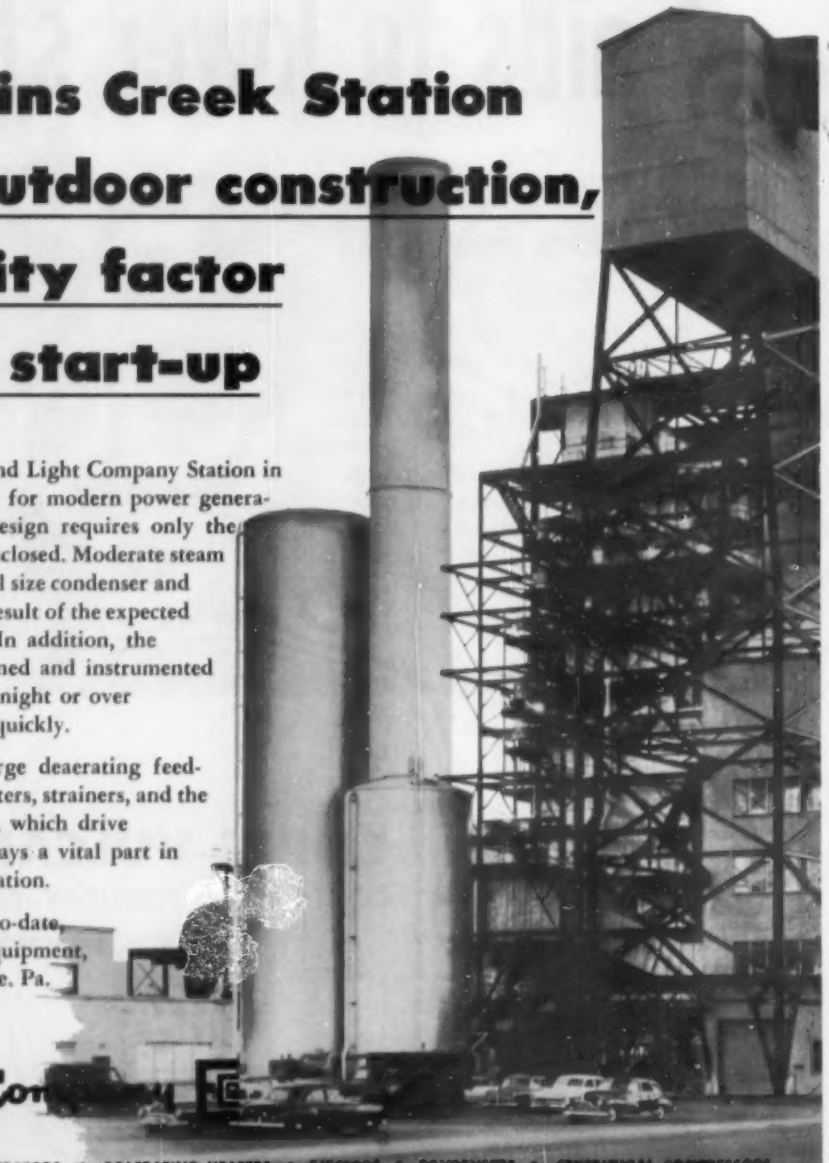
Copes Reducing Valves have ports characterized for specified flow and pressure conditions. Rugged construction throughout. *Write for Bulletin 477-A.*

Copes Desuperheaters are self-contained, need no "extras" for installation. Temperature control is accurate, even on lightest flows, because cooling water is fully controlled inside the chamber. *Bulletin 405-C.*



Elliott – playing a vital part in today's power

New Martins Creek Station features outdoor construction, low capacity factor and quick start-up



This new Pennsylvania Power and Light Company Station in eastern Pennsylvania is a model for modern power generation. Its economical outdoor design requires only the principal operating areas to be enclosed. Moderate steam pressures and temperatures, small size condenser and the absence of reheat all are the result of the expected low capacity factor operation. In addition, the initial 132,500-kw unit is designed and instrumented so that it may be shut down at night or over weekends, yet started up again quickly.

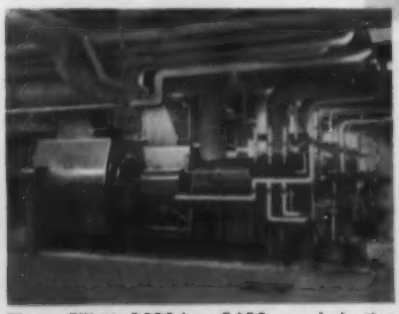
Elliott equipment including large deaerating feedwater heaters, evaporator preheaters, strainers, and the electric motors, 1½ to 2500 hp, which drive important station auxiliaries, plays a vital part in the efficient operation of the station.

For descriptive literature on up-to-date, cost-saving steam and electric equipment, write Elliott Company, Jeannette, Pa.

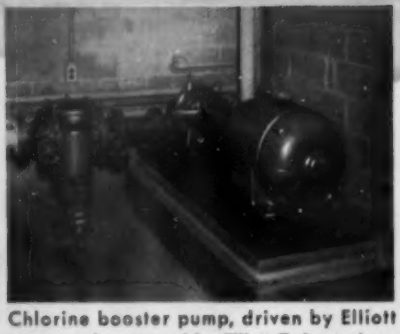
ELLIOTT Co

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS

QS-2



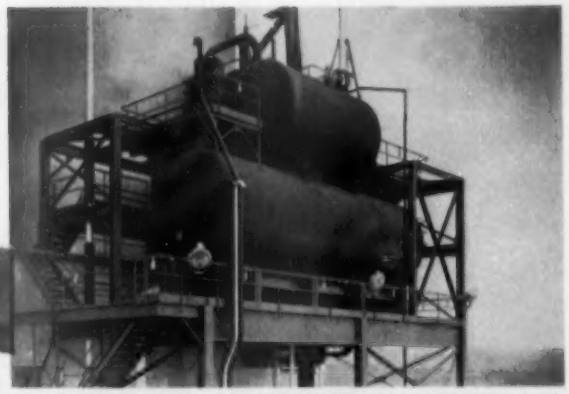
Three Elliott 2500-hp, 3600-rpm induction motors driving boiler-feed pumps.



Chlorine booster pump, driven by Elliott motor and protected by Elliott Twin strainer.

Elliott raw water strainer and two Elliott C-W motors driving pumps.

expansion . . .



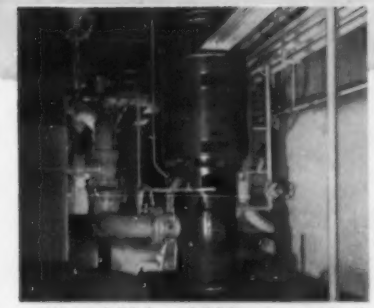
A close-up of the Elliott 1,400,000-lb-per-hr deaerating feedwater heater, serving the first unit.

Unit No. 1 of the new Martins Creek Steam Electric Station is operating, with duplicate unit under construction.

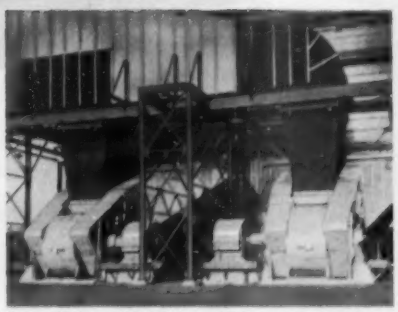
Two Elliott 500-hp, 440-rpm vertical weather-protected motors driving circulating water pumps during snowstorms.

The snow doesn't bother this Elliott 700-hp, 1200-rpm, weather-protected motor driving forced-draft fan.

• TURBOCHARGERS • TUBE CLEANERS • STRAINERS

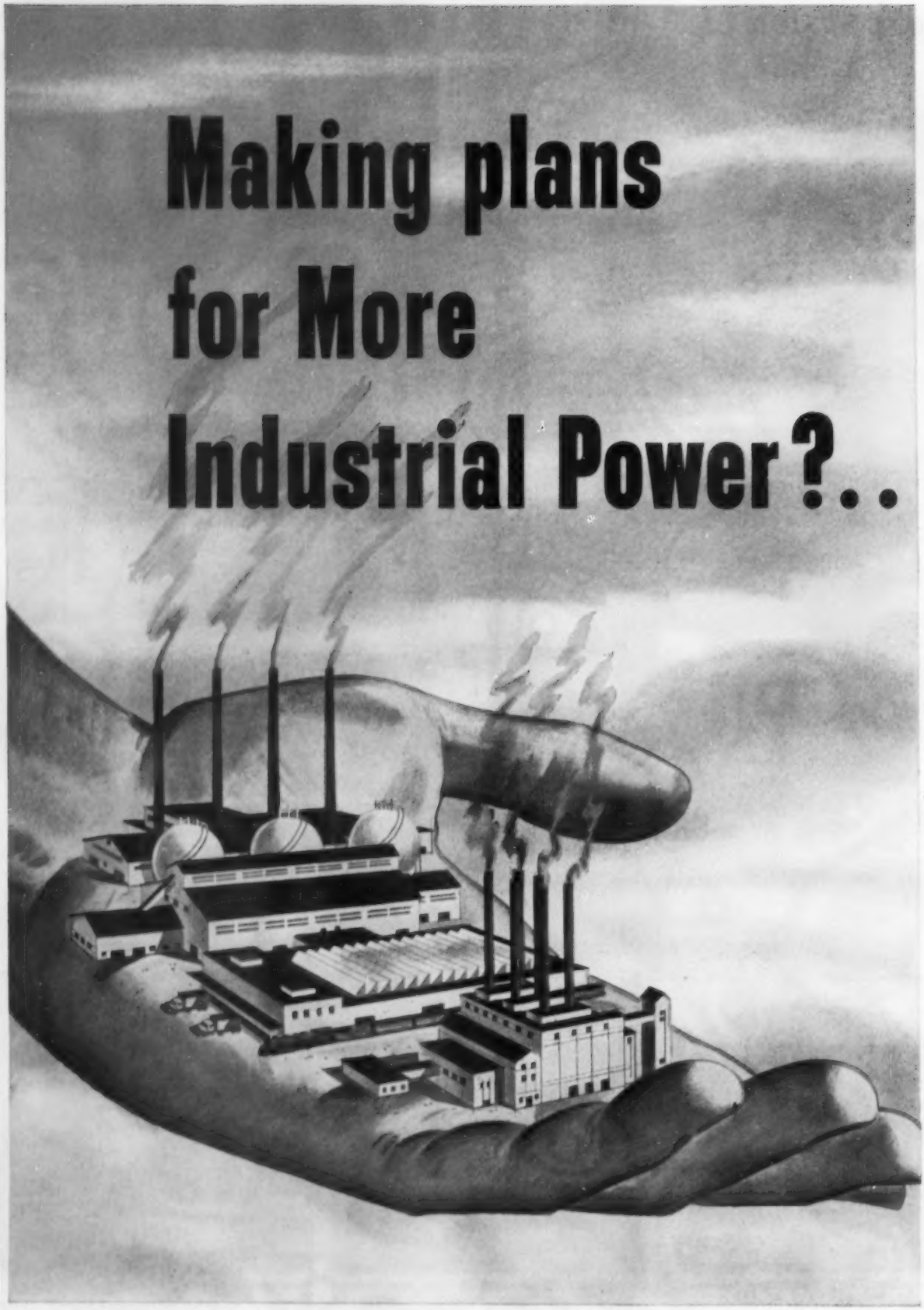


Elliott 350-hp, 1200-rpm vertical motors drive condenser hotwell pumps.

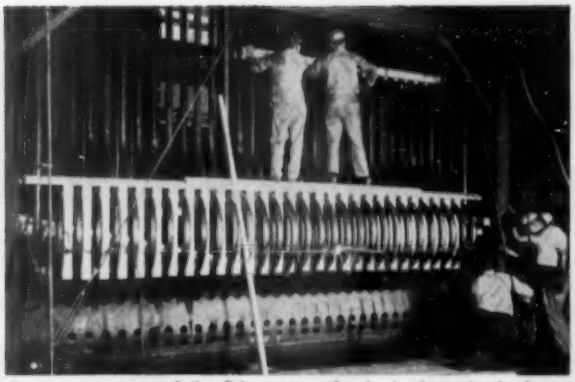


Two Elliott 1250-hp, 900-rpm, weather-protected motors driving induced-draft fans.

Two of the four Elliott 600-hp, 360-rpm motors which drive pulverizer mills.


Making plans
for More
Industrial Power?..

FARROWTEST® is Republic's exclusive method of checking ELECTRUNITE Boiler Tubes for irregularities in the metal and the weld. By catching these defects before the tubing is shipped, it can effect savings for users of both boiler and heat exchanger tubing. Typical applications where this testing pays off are: industrial and utility boilers.



Because ELECTRUNITE Boiler Tubes are uniformly ductile, spring-back can be accurately calculated before the bending operation. Bends are smooth, accurate. This is part of the new 100,000 lbs./hr.—750 PSI—750 F. Steam Generating Unit installation at Kellogg Co., Battle Creek, Mich. Designed, built and installed by Riley Stoker Corp., Worcester, Mass.

Like Kellogg Co., be sure you get REPUBLIC Electrunite Boiler Tubes

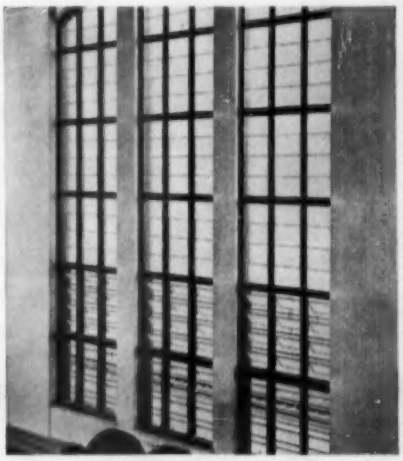
When your blueprints are ready, follow the example of The Kellogg Company: see that Republic ELECTRUNITE Boiler Tubes are specified.

Then you'll be sure you get the power you're buying.

These dependable electric resistance-welded boiler tubes give uniform heat transfer all around the tube from end to end, because wall thickness is uniform. Smooth bending and roller expanding are possible because ductility is uniform. Installation is easier and often less expensive.

These are only some of the reasons why more and more consulting engineers are specifying these quality-controlled boiler tubes. Not only for new plants, but also for old ones being modernized.

It's a question of economics. And over the long haul, Republic ELECTRUNITE Boiler Tubes are a good investment. Before you decide on your specifications, get all the facts about Republic ELECTRUNITE Boiler Tubes. They're the original Electric Welded Boiler Tubes. Write for literature. Or call your nearest Republic district sales office.



Power plant equipment operating at high pressure creates special window problems. Because of rapid air consumption, pressure variations occur. Windows must open and close rapidly to compensate. That's why this station is now equipped with Truscon Donovan Windows. Ventilators open and close rapidly and simultaneously. Air pressure is more precisely controlled. Maintenance has been substantially reduced.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL

REPUBLIC STEEL CORPORATION
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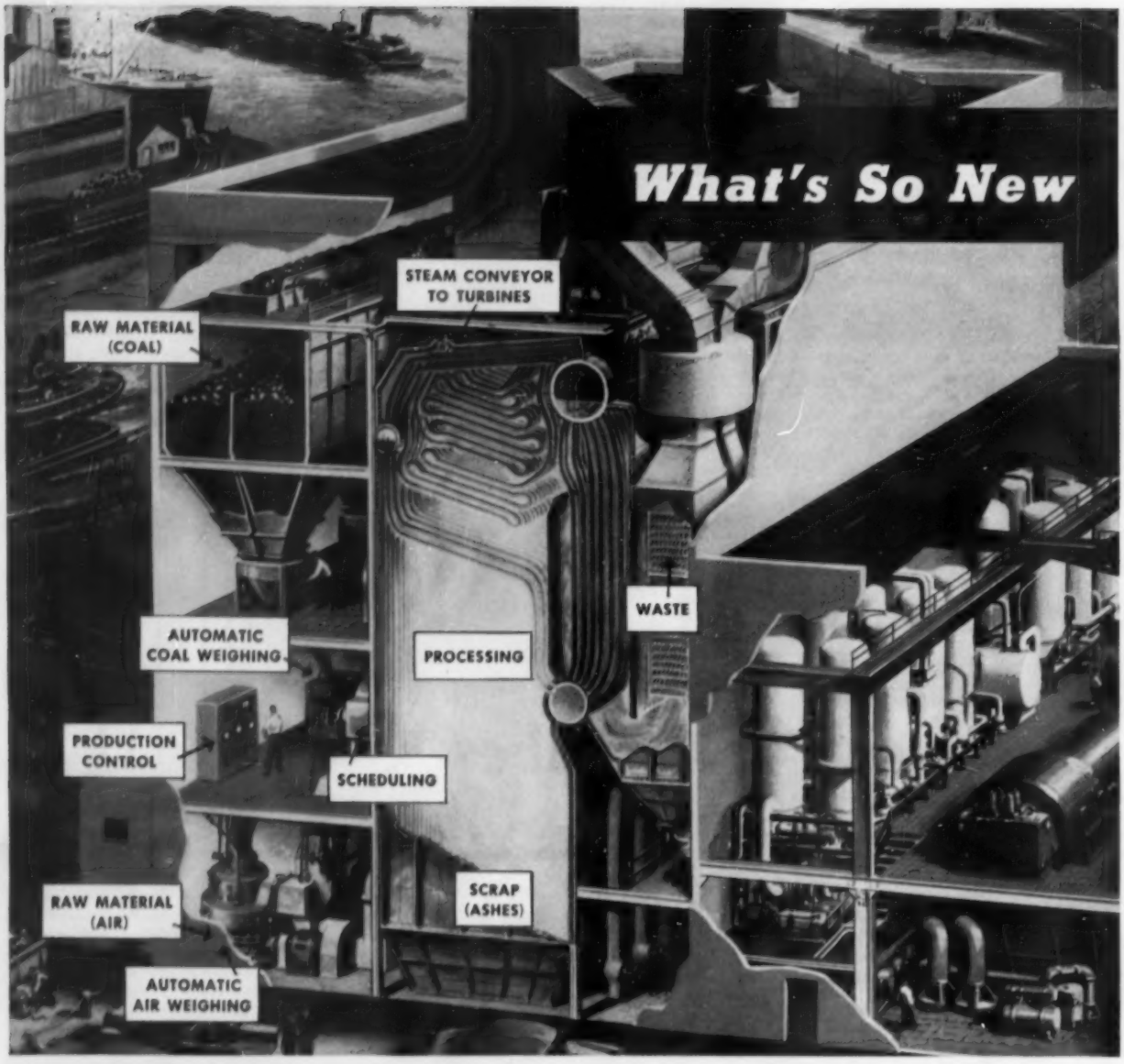
Please send me more details on
☐ Truscon Donovan Windows ☐ ELECTRUNITE® Boiler Tubes
☐ ELECTRUNITE Pressure Tubes ☐ FARROWTEST®

Name_____ Title_____

Company_____

Address_____

City_____ State_____



View Courtesy of the Armstrong Cork Company

This Is How a Factory Man Might Look at a Power Plant

That's because, in most plants, it's a completely automatic manufacturing operation, converting fuel and air into available heat and condensate and make-up water into steam for processes and turbine generators. Instruments and controls make it possible to achieve the full efficiency that has been built into the modern power plant.

REPUBLIC FLOW METERS CO.

About Automatic Factories?

. . . Power "Factories" Have Been Operated Automatically for Years!

THEY say it's coming — automatic production of automobiles, appliances and the thousands of other things we need and use. It's a startling thought, this idea of factories that will need only human supervision and maintenance and nothing more.

Yet, when you look at your own power plant, the idea doesn't seem so new after all. For power plants are actually factories. They produce products — steam and electricity — that are distributed, sold and used by millions daily.

PIONEERS OF AUTOMATIC FACTORIES

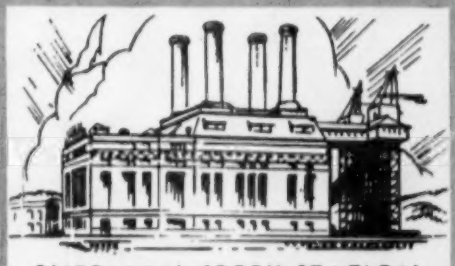
It is the power industry that has actually pioneered automatic factories. Almost 30 years ago the first power plant was operated entirely by automatic controls. Control principles learned from this and thousands of subsequent installations are guiding today's designers of the factories of tomorrow.

The Smoot Engineering Corporation, which made this first control installation, was acquired by Republic Flow Meters Co. some 20 years ago. Since then, Republic has carried on the Smoot leadership in the automatic operation of power plants, manufacturing a complete line of instruments and controls for this purpose. For example, a recent Republic development, the Electronic Telemaster, has made possible the control of large boilers where components are so distant that transmission lags in ordinary control systems would prohibit automatic operation.

With this wealth of past experience and an active development program to guide them, Republic engineers are able to give you the latest features in control systems to best meet your present and *future* needs.

REPUBLIC Automatic COMBUSTION CONTROLS

- For all types and sizes of boilers
- For all arrangements of draft
- For all types of fuel firing
- For all load conditions



SHERMAN CREEK STATION

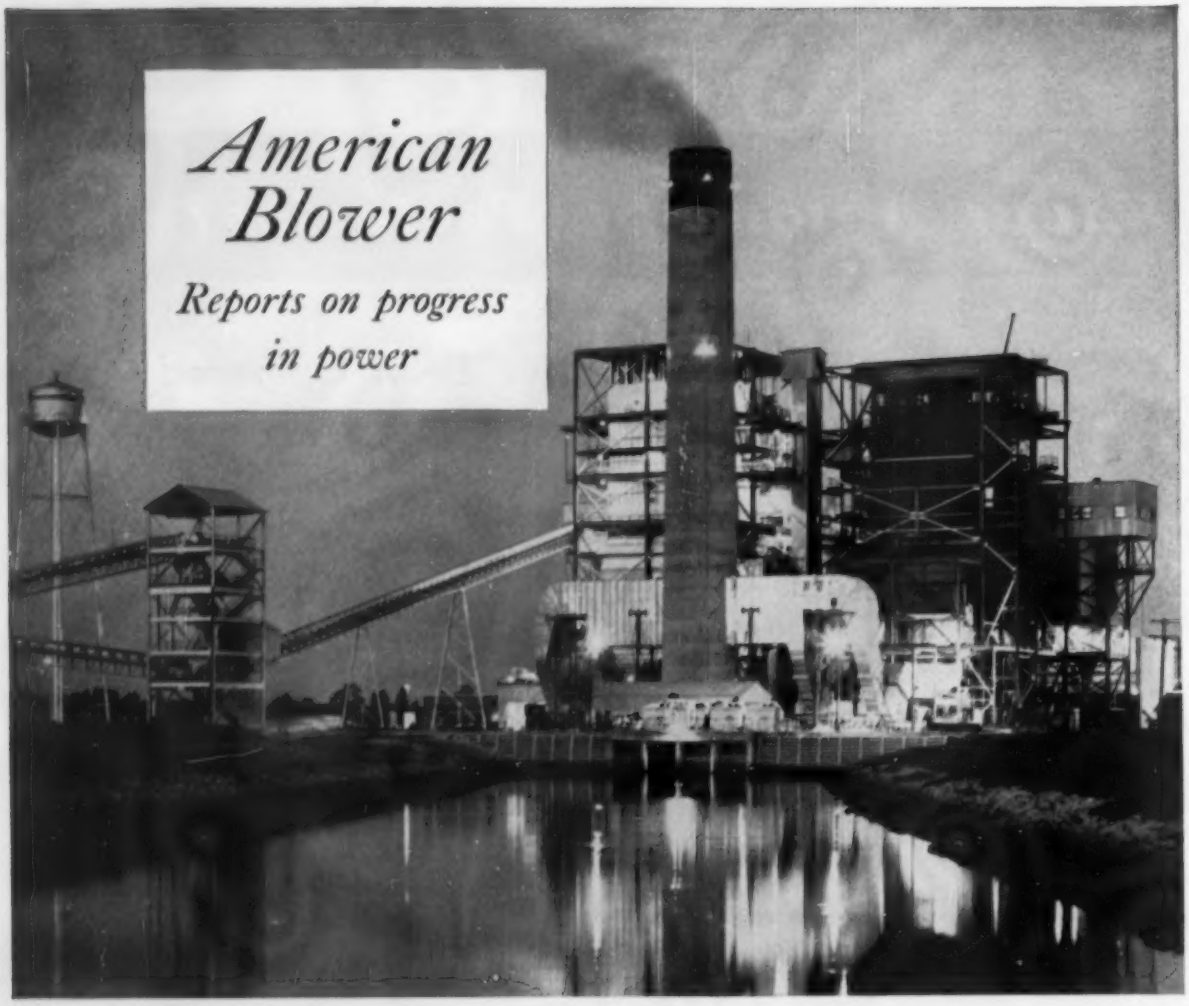
WHERE AUTOMATIC POWER PLANT OPERATION WAS FIRST PROVED PRACTICAL . . . 30 YEARS AGO!

In 1922, Smoot Controls (now incorporated into the Republic line of instruments and controls) were installed on four boilers at New York's Sherman Creek Station in an experiment to test the feasability of controlling combustion automatically. Within five months, the superior performance of boilers with these controls was so conclusively demonstrated that the entire plant, consisting of 44 boilers, was equipped with Smoot Controls. After this test proved it was practical to control boilers with other machines, it was only a short time before automatic boiler controls were installed in scores of power plants all over the country.

2240 Diversey Parkway • Chicago 47, Illinois

American Blower

Reports on progress in power



CP&L's new plant at Wilmington, N.C., has been named the *Louis V. Sutton Steam Electric Generating Plant* in honor of the company's president. The first mammoth boiler of this outdoor-type unit towers 17 stories high, and produces steam up to 1,000° F with 1,600 lbs. pressure per sq. in. CP&L's system includes three other large fuel-burning plants, plus three large hydroelectric plants.

For new #1 unit of Louis V. Sutton Plant, CP&L installed these two American Blower Sirocco Induced Draft Fans. Each is rated @ 225,000 cfm @ 585 rpm @ 291° F @ 16" sp. If *your* plans call for mechanical draft equipment, fly ash precipitators, heavy-duty steam coils, or fluid drives for boiler feed pump and fan control — contact your American Blower Branch Office, today.

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS &

Carolina Power & Light Co. ups capability to 922,000 kw with new outdoor unit

Carolina Power & Light Company's new steam plant reflects design progress, uses American Blower Draft Fans

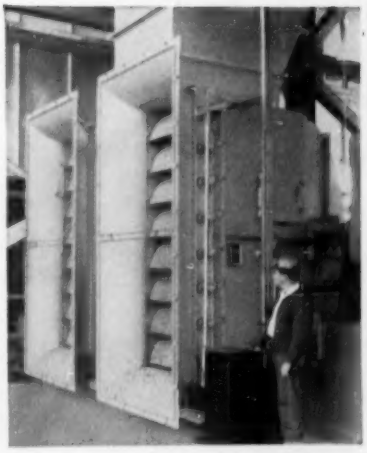
The new Louis V. Sutton Steam Electric Generating Plant at Wilmington, N.C., is the Carolina Power & Light Company's first plant of outdoor-type construction to be built entirely above ground. No. 1 unit, which went into operation July 1954, adds 105,000 kw to CP&L's generating network, boosting total capability to 922,000 kw!

Laid out for a maximum of six generating units, this new plant will be the largest in the company's vast system . . . a system that serves over 2,000,000 people in 30,000 square miles of the Carolinas. Its outdoor design saves on construction costs and time, and reflects CP&L's many years of progress: continually expanding and increasing service to customers.

Along with cost-cutting outdoor construction, CP&L chose efficient and dependable equipment, including American Blower Forced and Induced Draft Fans.

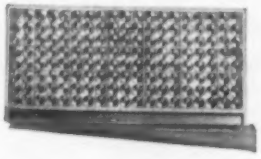
Across our nation, progressive, investor-owned utilities prefer American Blower equipment because it performs at peak efficiency, indoors or out, with minimum maintenance. They know you can rely on American Blower's Forced and Induced Draft Fans, Fly Ash Collectors, Gyrol Fluid Drives for boiler feed pump and fan control, and Heavy-duty Steam Coils.

May we assist in *your* progressive program? Give your nearest American Blower Branch Office a call, or write us direct.

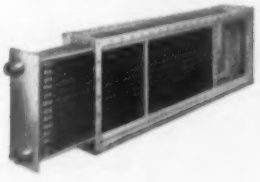


This is one of two American Blower Sirocco Forced Draft Fans installed on #1 unit at CP&L's Louis V. Sutton plant. It is rated @ 140,000 cfm @ 585 rpm @ 100° F @ 14.4" sp.

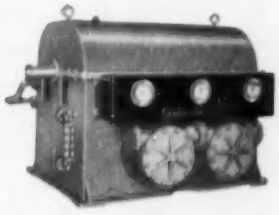
Mechanical Draft Fans for induced and forced draft



Collectors and precipitators for dust and fly ash control



Heavy-duty steam coils for high pressure duty



Gyrol Fluid Drives for boiler feed pump and fan control

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

Ingersoll-Rand does it again!

New 110,000 sq. ft. condenser, serving at State Line Station of Chicago

DEMONSTRATES SUPERIOR

The new condenser at Chicago's State Line Station offers another example of the adaptability of Ingersoll-Rand condenser design. It consists of two shells, installed parallel to the shaft of the low-pressure element of the cross-compound steam turbine generator. Each shell has 55,000 sq. ft. condensing surface and forms a unified construction with the turbine's side exhaust which it serves. This forward-looking design for Unit No. 3 eliminates the problems which would have been encountered if vertical condensers had been used in this design.

Ingersoll-Rand surface condensers have long set the pace in central station practice. Back in 1920, the basic principle of the I-R surface condenser was introduced as an entirely new concept in design. Ever since, an extensive program of research has been carried on to construct condensers that give top performance in minimum space—under any specified operating conditions. This design for the State Line Station is typical of Ingersoll-Rand's leadership in surface condenser progress.

Ingersoll-Rand horizontal condensate pumps will be used—and three I-R 10-stage Class CHTA "double-case" high-pressure boiler feed pumps will also serve Unit No. 3 at State Line. Ask to have an I-R specialist study your power plant equipment needs—and submit recommendations to meet your particular requirements.

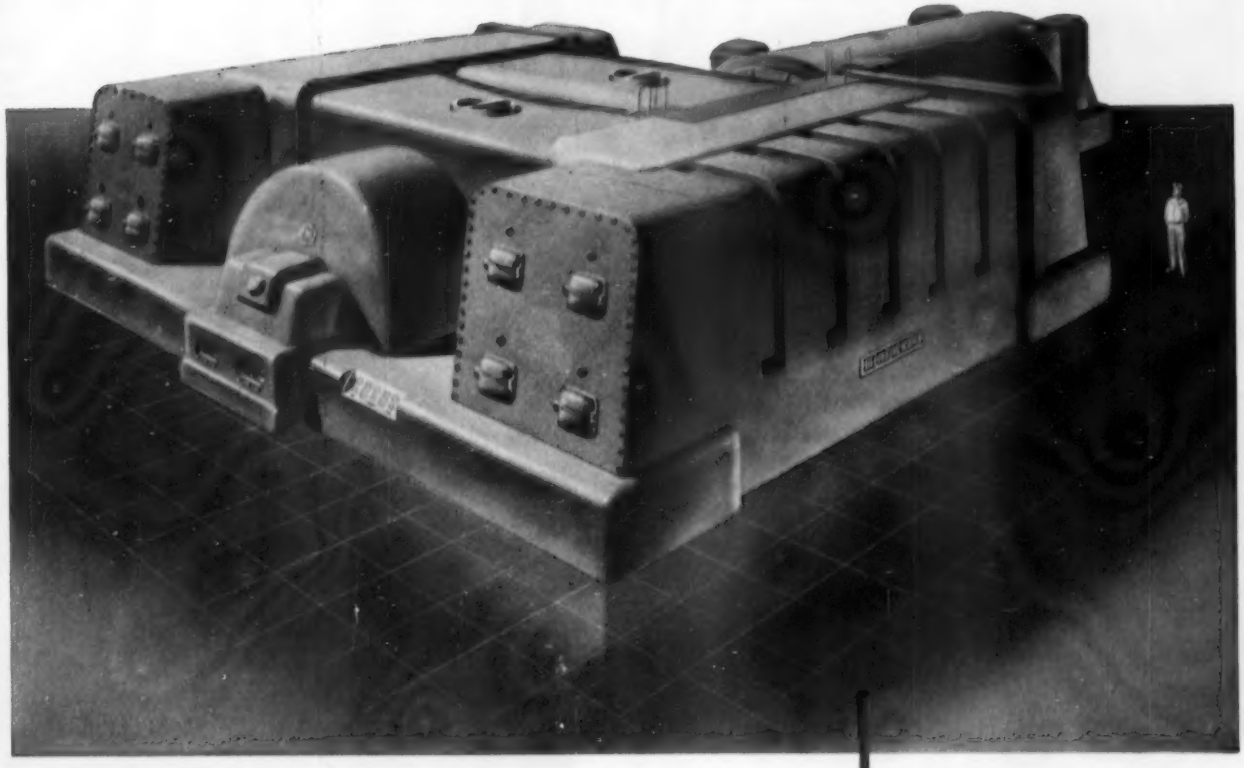
**Wholly owned subsidiary of Commonwealth Edison Company*

PUMPS* COMPRESSORS* GAS AND DIESEL ENGINES* AIR AND ELECTRIC TOOLS •

191,000 kw Unit No. 3

District Electric Generating Corporation*

ADAPTABILITY OF I-R DESIGN



Ingersoll-Rand 110,000 sq. ft. twin-shell surface condenser, to be installed in State Line Station, Chicago District Electric Generating Corporation. Sargent & Lundy, Consulting Engineers.

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

4-126

VACUUM EQUIPMENT • ROCK DRILLS • TURBO-BLOWERS

"this is

● Engineers tell us Yarway Remote Liquid Level Indicators are the most dependable boiler insurance they can have.

Instant . . . accurate . . . brilliant . . . continuous readings of boiler water level are seen on the panel or wherever you wish in your plant. You know the readings are right because they are controlled by the boiler water itself . . . by the pressure differential between a constant head of water and the varying head in the boiler drum. *Indicating mechanism is never under pressure.*

Yarway Indicators may be equipped with a Yarway Control Unit that operates Remote Hi-Lo-Alarm signal lights or horns. For a 24-hour record of boiler water levels, use the Yarway Hi-Lo-Graph Recorder.

On the boiler drum itself you'll want Yarway Water Gages . . . and these "bright as a star" gage readings can now be televised with a Yarway—RCA Television chain.

From drum to panel and at all remote locations, Yarway equipment gives you the safest boiler protection you can buy . . . proved beyond doubt in thousands of power plants.

Write for the specific bulletins you want.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

NEW! WIDER VISION!

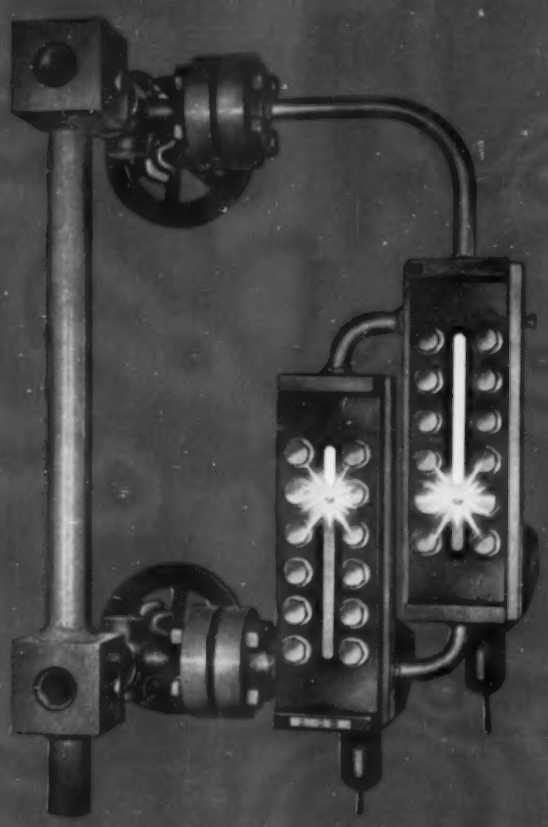
Clear, brilliant readings from any angle, are possible with the new "wide vision" face on the Yarway Remote Liquid Level Indicator. Pointer is always visible, even at extreme high and low water levels.

The Yarway Indicator is manometric type with automatic temperature compensation, as approved for use under the ruling of A.S.M.E. Boiler Code Committee in Case #1155.

Described in Yarway Bulletin WG-1824.

YARWAY

good boiler insurance!"



YARWAY WATER GAGES

Flat glass, high pressure type shown, features new separated-design insert and Type "M" illumination that causes water level meniscus to "shine like a star". Described in Yarway Bulletin WG-1812.

YARWAY REMOTE SIGNAL ALARMS

Lights on horns, operated by Control Unit on Yarway Indicator, give instant warning of any serious deviation from normal water level. Can be located anywhere in plant. Described in Yarway Bulletin WG-1824.

YARWAY HI-LO-GRAPH RECORDER

Gives a continuous 24-hour record of liquid levels. Actuating mechanism is same as in Yarway Indicator. Used both for indicating and recording. Described in Yarway Bulletin WG-1830.

YARWAY TELEVISION

Simplified system consists of compact camera and panel-mounted monitor. Clear, bright image of water level gage anywhere in the plant.
Described in Yarway Bulletin WG-1813.

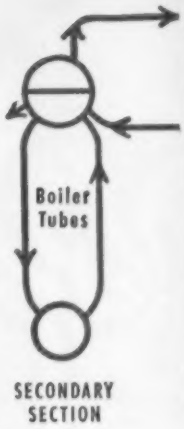
steam plant equipment

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
LIQUID LEVEL INDICATORS
EXPANSION JOINTS
STEAM TRAPS
STRAINERS
SPRAY NOZZLES
DIGESTER VALVES

dual circulation

provide high-purity steam

- with high feedwater makeup
- with high silica content feedwater
- at pressures above 600 psi



Cost-saving advantages of the exclusive FW dual circulation system now thoroughly proved by over 6 years of successful operation

THE DUAL CIRCULATION STEAM GENERATOR was developed by Foster Wheeler to provide a practical means of reducing carryover of silica and dissolved solids from 100% makeup feedwater. At pressures over 600 psi, this carryover often causes costly turbine outages. With today's trend to higher pressures and temperatures, and larger sized units, carryover problems are sharply accentuated and the dual circulation principle offers still greater advantages.

As shown in the diagram above, the Dual Circulation Steam Generator utilizes two separate heat-absorbing sections, each with its own independent natural circulating system. The primary section, comprising principally the furnace walls, is blown down at a high rate, providing the feed to the secondary section. Steam from the secondary system is returned to the primary, where it is condensed in whole or in part by the incoming feedwater. Hence, virtually all of the steam delivered to the turbine is generated in the low-concentration primary section, thus sharply reducing silica carryover and total dissolved solids.

Predicted data on the first FW Dual Circulation Steam Generators have been fully confirmed by more than six years of operation with five 300,000 lb/hr, 1350 psi units having 100% makeup. Average silica carryover is only .004 ppm, compared to .08 ppm expected for a boiler of conventional circulation. Carryover of total dissolved solids is .007 ppm, compared to .56 ppm expected for a conventional unit.

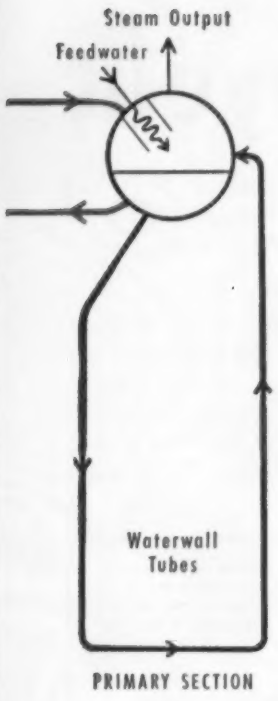
Additional benefits include reduction of tube damage due to low concentration in primary section; reduced final blowdown with substantial saving in blowdown heat recovery equipment; and reduced cost of the makeup treating plant.

Wherever *high purity steam* is required, in central station or industrial service, FW Dual Circulation Steam Generators offer important savings in operating and maintenance cost.

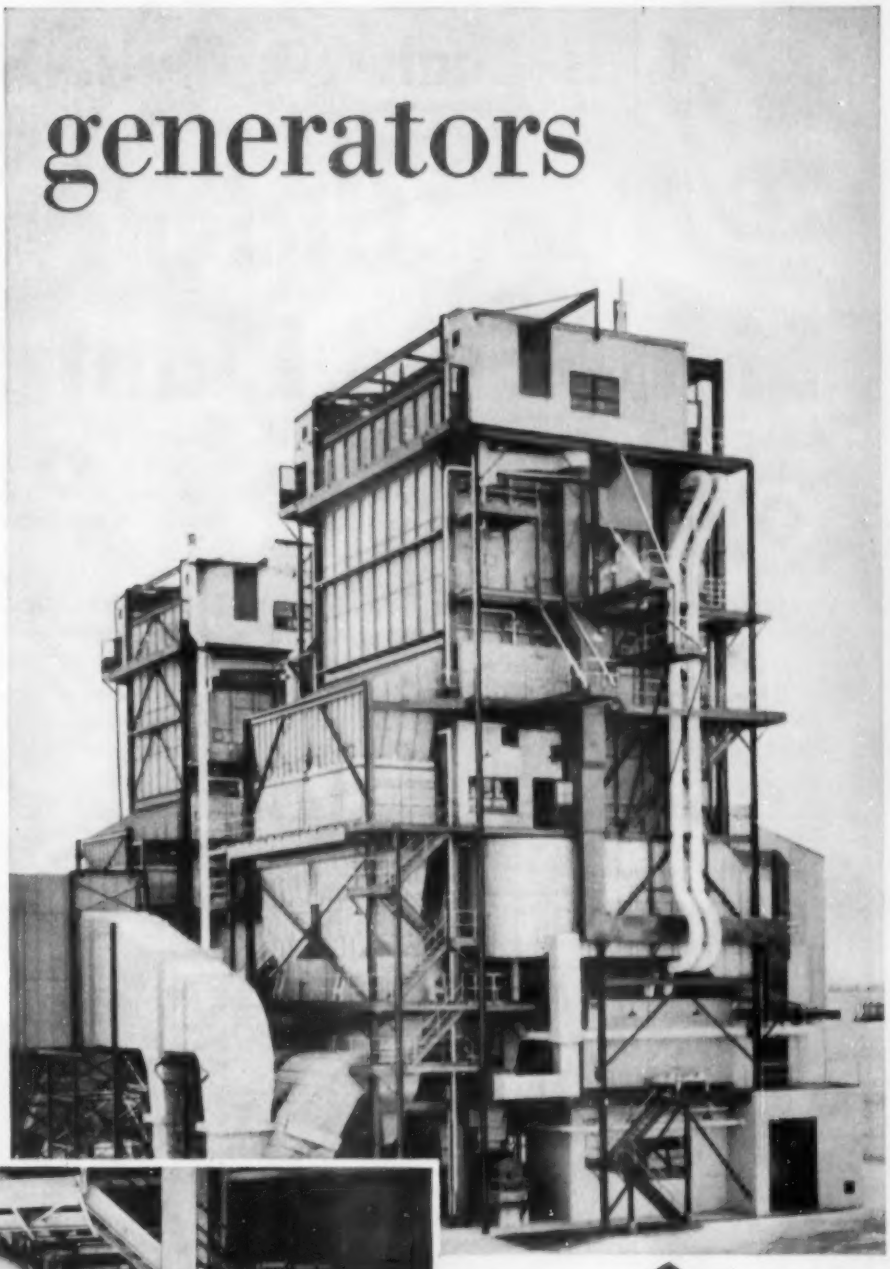
FOR COMPLETE INFORMATION on FW Dual Circulation Steam Generators, send for your free copy of 16-page Bulletin B-50-11. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

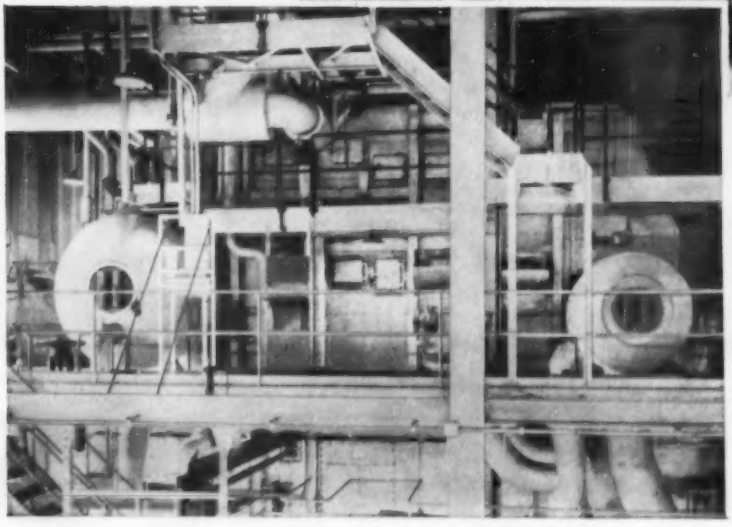
steam generators



Simplified flow diagram of typical 3-drum Dual Circulation unit. Blowdown from primary feeds continuously into secondary section. Final blowdown is from secondary drum.



KANSAS GAS AND ELECTRIC CO. recently installed these two FW Dual Circulation units at the Murray Gill Steam Electric Station. One has a capacity of 425,000 lb/hr and the other, 625,000 lb/hr —both operating at 1350 psi, 955F. Consulting Engineers were Ebasco Services, Inc.



A LARGE MID-WESTERN REFINER has installed five FW Dual Circulation Steam Generators, each unit designed for 300,000 lb/hr at 1350 psi, 900F, with 100% feedwater makeup. Photo shows upper drums of one of the five 3-drum units. Consulting Engineers were Stone and Webster Engineering Corp.

Allis-Chalmers Multi-Steam Path

Top Efficiency . . . Simplified Plant Layout

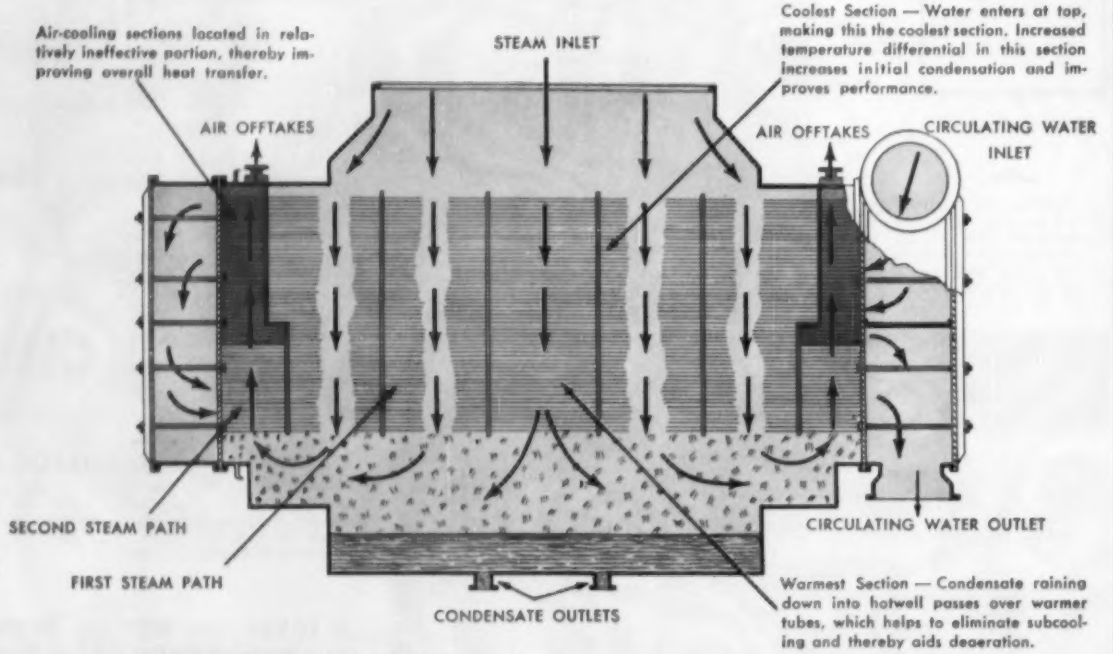
HERE'S WHY: Allis-Chalmers multi-steam path condenser design makes all tubes completely effective by directing the steam to even the remote sections of the condenser, thereby producing a high vacuum.

Steam, penetrating all parts of the condenser, keeps condensate temperature high and drives off dissolved oxygen.

This combination of high vacuum, high condensate temperature and good deaeration means high operating efficiency.

Plant layout problems are simplified, too! Allis-Chalmers multi-steam path condensers can be built in round, oval or rectangular shape, in any type or size.

GET INFORMATION: 24-page bulletin 19B7987 tells the story about the unsurpassed design, unmatched manufacturing facilities and A-C experience from building over 20 million square feet of condensers. Call your nearby A-C office for a copy, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

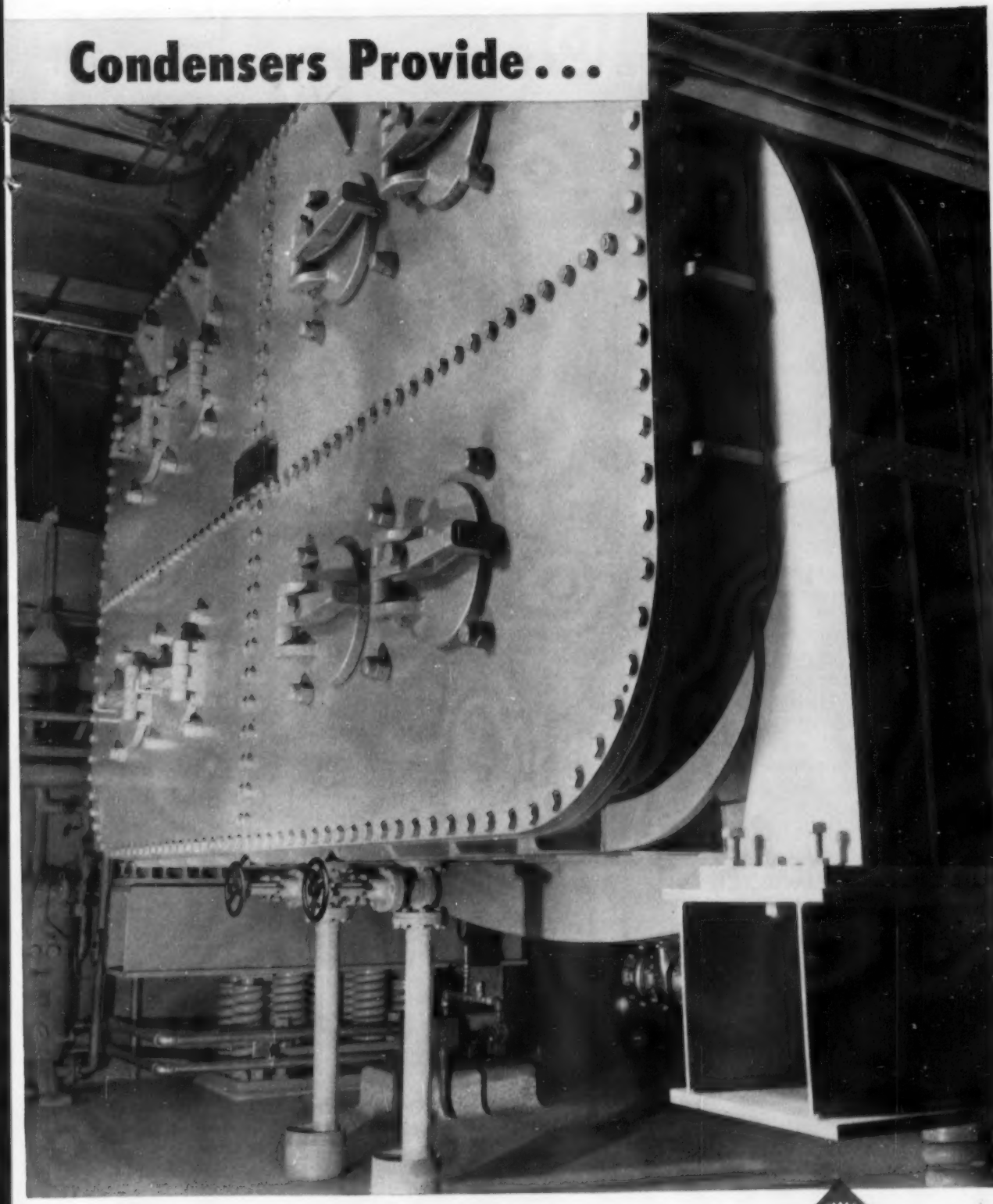

Air-cooling sections located in relatively ineffective portion, thereby improving overall heat transfer.
STEAM INLET
Coolest Section — Water enters at top, making this the coolest section. Increased temperature differential in this section increases initial condensation and improves performance.
AIR OFFTAKES
AIR OFFTAKES
CIRCULATING WATER INLET
SECOND STEAM PATH
FIRST STEAM PATH
CONDENSATE OUTLETS
CIRCULATING WATER OUTLET
Warmest Section — Condensate raining down into hotwell passes over warmer tubes, which helps to eliminate subcooling and thereby aids deaeration.

Cross section of Allis-Chalmers two-pass multi-steam path condenser illustrates design features that make these condensers outstanding in the industry.

A-4598

ALLIS-

Condensers Provide . . .



CHALMERS

A-C ALLIS-CHALMERS

ERIE CITY
115 Years in Steam Generation

ERIE CITY IRON WORKS • Erie, Pa.
STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

You can depend on Erie City for sound engineering

A NEW USE FOR STEAM at BREA CHEMICALS INC.

designed by BREA CHEMICALS INC.
constructed by C. F. BRAUN & CO.

Brea Chemicals, Inc. at Brea, California applies sound engineering to produce ammonia from air, water, and natural gas.

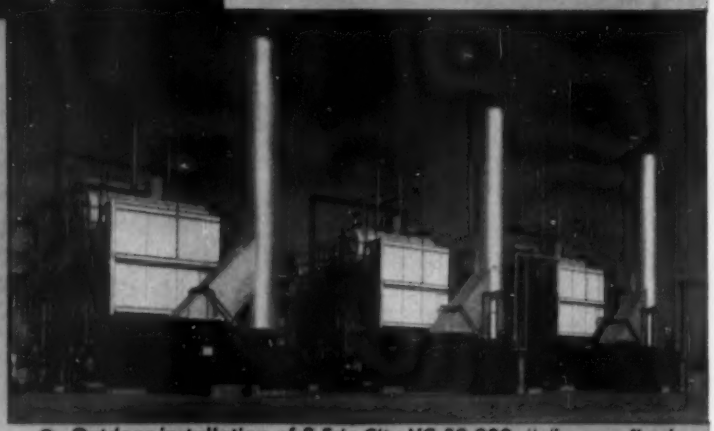
The air is washed clean of carbon dioxide with caustic; compressed, dried, and liquified. The liquid air is fractionated, and the overhead nitrogen product is one of the basic materials for ammonia synthesis.

Water is added to three Erie City VC Steam Generators and becomes steam. Part of this steam reacts with natural gas in a reforming furnace. The effluent gas contains hydrogen, oxides of carbon, and methane. The flue gases from the furnace are used as a source of waste heat to operate two Erie City VL steam generators. The steam from these generators augments plant steam requirements at low cost.

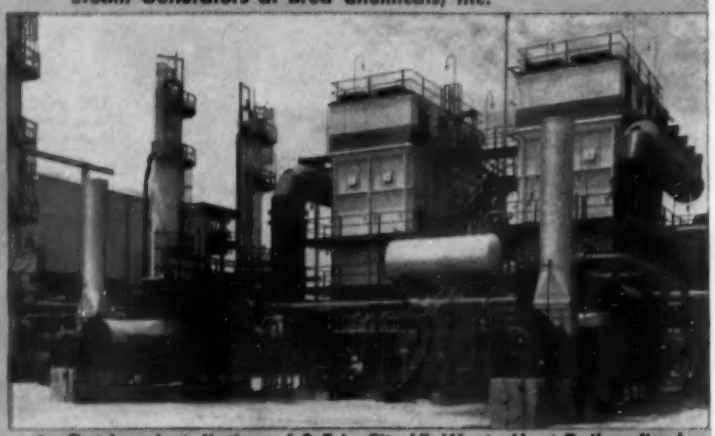
Carbon dioxide is removed from the reformed gas by scrubbing with a liquid amine solution, recovered, and processed to form dry ice. The carbon monoxide and methane are removed by scrubbing with liquid nitrogen. The overhead product from the nitrogen wash column is a mixture of hydrogen and nitrogen ready for the synthesis operation.

Ammonia from the Brea process provides the foundation for servicing the farmer with aqua ammonia, aqua ammonium phosphate, and ammonium sulfate, and in the near future—ammonium nitrate.

Erie City through the application of sound engineering in the design of its products, is proud of the part it plays in this new petrochemical industry.

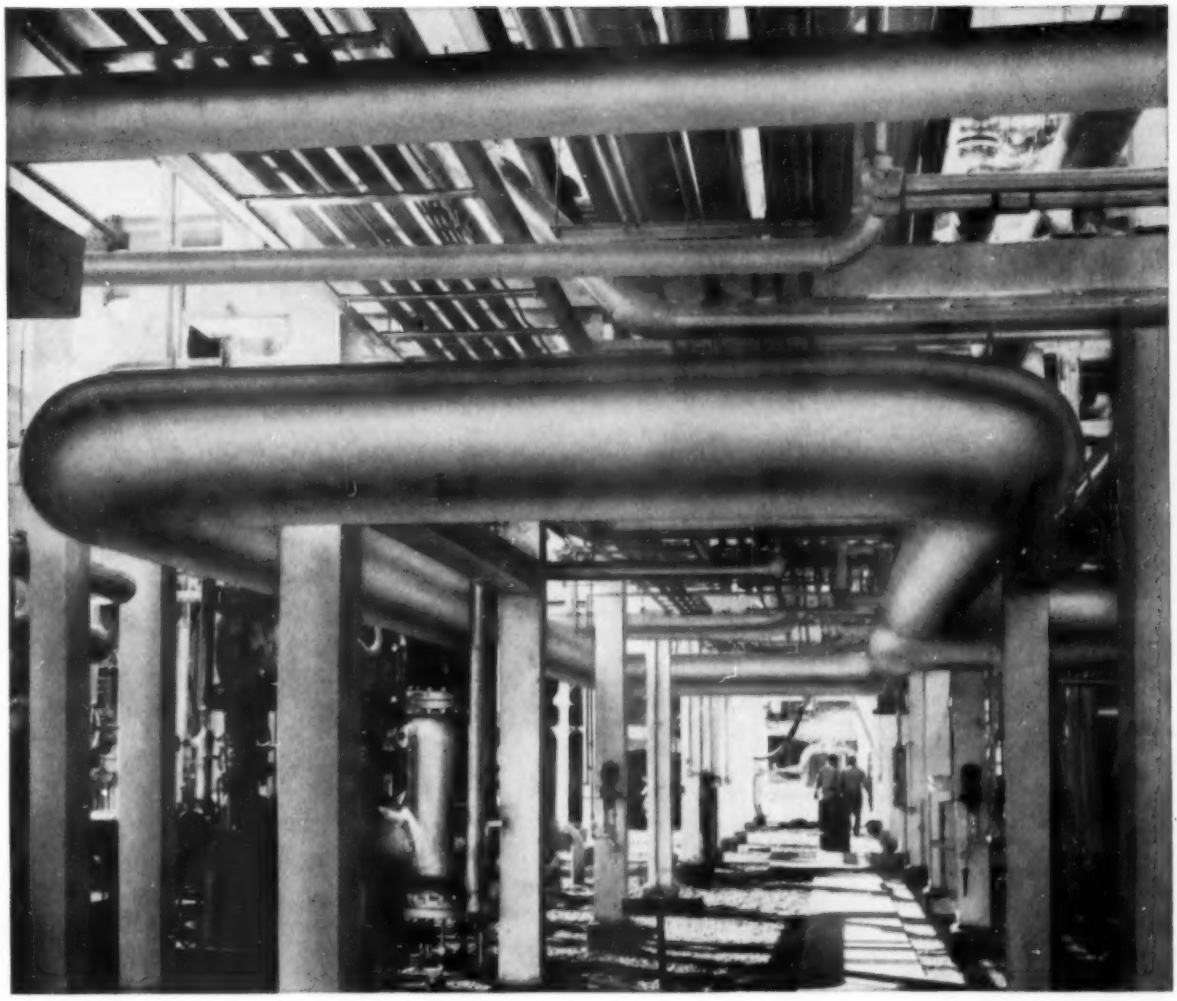


● Outdoor installation of 3 Erie City VC 50,000 #/hr. gas fired Steam Generators at Brea Chemicals, Inc.



● Outdoor installation of 2 Erie City VL Waste Heat Boilers fired by flue gases from the Reform Furnaces shown above.

● Air view of the Brea Chemicals Inc. Ammonia Plant at Brea, Cal.



Less heat loss at joints with single-layer Unibestos® Pipe Insulation

Tests prove that Unibestos single-layer pipe insulation actually provides greater protection than other nonfibrous *double-layer* insulations which cost more to install. Unibestos is made of Amosite—the long-fibered African asbestos. These fibers interlock with one another to prevent heat loss at horizontal and longitudinal joints.

While most insulating materials show a pronounced shrinkage at high temperatures, Unibestos has no measurable shrinkage at 1200°F. It will not powder, pulp or wash off, even under heavy moisture conditions, and when dry, Unibestos resumes its original thermal and physical characteristics.

EASY to install . . . easy to remove.

Unibestos can be cut, mitered and handled easily. The fabrication of insulation for tees, valves, flange covers, etc., is a fast, low-cost operation. Because of its unusual strength and durability Unibestos can be removed and replaced with little or no loss of material.

STANDARD PRODUCTION SIZES

Unibestos Pipe Insulation is regularly made in 3-foot lengths for pipe sizes from ½″ through 24″, in standard thicknesses through 5″. Unibestos Block Insulation is made in 6″, 12″, 18″ or 36″ widths and in thicknesses from 1″ through 3″ in ½″ increments.

For complete information, write for descriptive Bulletin 109C

UNARCO

UNION ASBESTOS & RUBBER COMPANY

332 South Michigan Avenue • Chicago 4, Illinois

Depend on LADISH

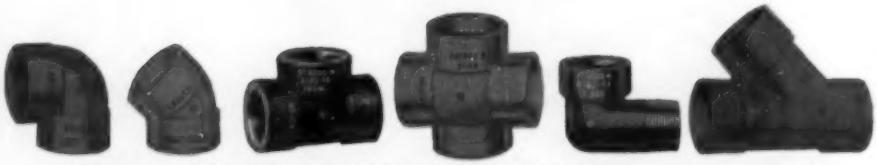
- Carbon Steels
- Carbon-Molybdenum Steels
- Chromium-Molybdenum Steels
- Nickel Steels
- Chromium-Nickel Steels
- Chromium-Silicon-Molybdenum
- Wrought Iron
- Chromium Type Stainless
- Chromium-Nickel Stainless
- Molybdenum Type Stainless
- Wrought Aluminum
- Aluminum-Copper Alloys

BUTT WELDING FITTINGS

½ inch through 42 inches . . .

FORGED CORROSION RESISTANT—LIGHT WEIGHT and A.S.A. FLANGES

½ inch through 24 inches . . .



FORGED SCREWED OR SOCKET WELDING FITTINGS and UNIONS

⅛ inch through 4 inches . . .

LARGE DIAMETER AND T.E.M.A.* STANDARD FLANGES up to 20 feet O.D.

*Tubular Exchanger Manufacturers Association

LONG WELDING NECKS up to 24 inches, 150 lb. through 2500 lb.

Complete Service . . .

BUTT WELDING FITTINGS

Schedules 5S, 10S, 40S, 80S, and other Schedules and wall thickness.

FORGED CORROSION RESISTANT—LIGHT WEIGHT and A.S.A. FLANGES

150 lb. through 2500 lb. pressure ratings.

FORGED SCREWED OR SOCKET WELDING FITTINGS and UNIONS

150 lb. Corrosion Resistant and 2000 lb. through 6000 lb. ratings.

FOR FITTINGS FROM ANY FORGEABLE MATERIAL TO MEET YOUR SERVICE REQUIREMENTS

You get prompt, efficient service when you specify and order from the complete Ladish Controlled Quality line. Fittings *in any forgeable material* in virtually every type, size, wall thickness or pressure rating . . . are produced to one uncompromising Controlled Quality standard . . . and identified with heat code symbols pioneered by Ladish as verification of metallurgical integrity resulting from exhaustive tests made in the Ladish metallurgical laboratories.

For *complete service* on your fittings requirements, depend on the Ladish line and the services of your Authorized Ladish Distributor.

THE COMPLETE *Controlled Quality* FITTINGS LINE

LADISH CO.

CUDAHY, WISCONSIN

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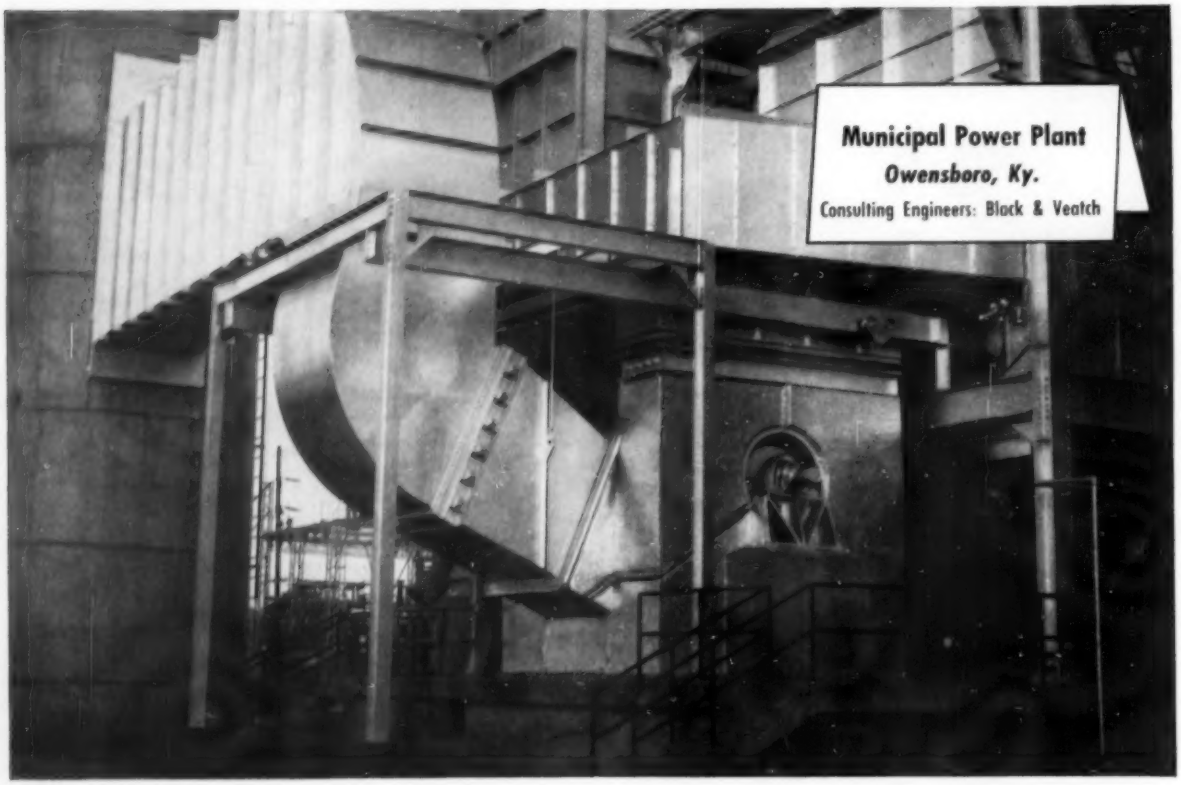
- Aluminum-Manganese Alloys
- Deoxidized Copper
- Hastelloy
- Titanium
- Forging Brass
- Everdur Bronze
- Silicon Bronze
- Manganese Bronze
- Wrought Nickel
- Nickel-Copper Alloys
- Inconel
- Monel

*Tubular Exchanger Manufacturers Association

Here's still another...



...new Municipal Power Plant using **CLARAGE** Fans!

● Serving the City of Owensboro, Kentucky, is this new addition to its power plant on the Ohio River.

Reported to be the largest and most efficient boiler installation in a municipal power plant east of California, it like so many others across the nation is Clarage equipped.

Forced draft is furnished by a Clarage Type W, Class IV fan delivering 108,000 CFM at 12.8" SP; induced draft by a Clarage Type RT fan, provided with shut-off type inlet dampers and an adjustable speed magnetic drive, which delivers 180,000 CFM at 12.2" SP.

Power plant people know that Clarage mechanical draft equipment on the job means satisfaction with the job. And this point has been PROVED in countless installations where Clarage fans have been giving economical, uninterrupted service for 30 years and longer. **CLARAGE FAN COMPANY, Kalamazoo, Michigan.**

You can Rely on **CLARAGE** ... *dependable equipment for making air your servant*

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES ● IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

Allis-Chalmers Supplementary Treatment

Eliminates All Scale!

WATER SOFTENING PLANTS SELDOM REMOVE all scale-forming material. In fact, only one part per million of hardness in feedwater will amount to twenty pounds of scale or sludge after twenty million pounds of steam is generated. In even a short period, this build-up can cause serious trouble. In addition, condensate is frequently contaminated.

To solve this problem, Allis-Chalmers has developed its supplementary treatments, which are formulated specifically to the requirements of individual plants.

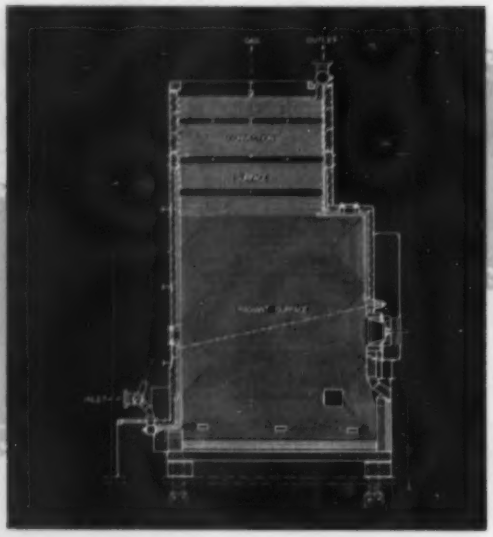
You can find out about factors involved in designing the proper supplementary treatment in Allis-Chalmers Water Conditioning Informational Bulletin 52. It explains how Allis-Chalmers water conditioning engineers approach this problem. Get a copy from your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wis.

A-4594

ALLIS-CHALMERS

WATER CONDITIONING—CHEMICALS, EQUIPMENT, SERVICE—FOR OVER 25 YEARS

A-C ALLIS CHALMERS



The New C-E La Mont Controlled Circulation Hot Water Boiler

For those applications where high temperature water has inherent advantages over steam—and there are many—the C-E La Mont H T Boiler has numerous points of superiority. Among the more important of these are:

1. **Complete control** over HT water movement in both system and boiler.
2. **Low pressure loss** is inherent so no separate boiler pump is required.
3. **Pressurized operation** with oil or gas means no induced draft fan—simple stack.
4. **Single-pass design** has no baffles—low draft loss—cleaner boiler.
5. **More efficient heating surface** can be arranged because of positive, controlled circulation.
6. **Other features** such as: steel enclosed setting—few headers, all accessible—any fuel, oil, gas or coal.

Available in sizes ranging from 15 to 150-million BTU per hour, or more—for pressures to 300 psi and temperatures to about 425 F.

MEET YOUR HEATING OR PROCESS NEEDS WITH ONE OF THESE C-E BOILERS

If you need steam—from 4,000 to 60,000 pounds per hour . . . or high-temperature water for heating or process applications . . . one of the three C-E Boilers shown here will fit your needs *exactly*.

Collectively they offer an exceptional diversity of choice, and a brief consideration of the features of each will help to "pin point" the design characteristics suited to your situation.

Of course, if larger capacities are needed the Combustion line includes boilers of any capacity—for any pressure—for any fuel or method of firing.

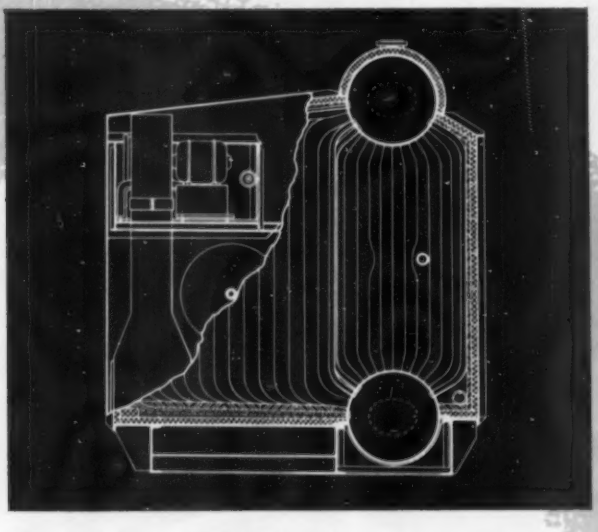
Please feel free to call upon us for further detailed information. Catalogs of each of the units illustrated are available upon request.

COMBUSTION ENGINEERING

C-E

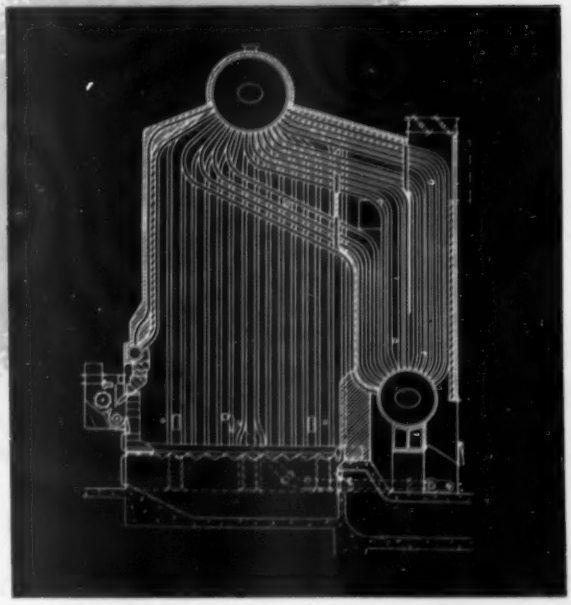
Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y. B-820

BOILERS, FUEL BURNING AND RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS AND FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE



The C-E Package Boiler, Type VP

This completely shop-assembled boiler is available in fourteen sizes from 4,000 to 42,000 pounds of steam per hour . . . for design pressures up to 500 psi . . . up to 200 degrees of superheat available in sizes above 21,000 pounds capacity . . . for pressure firing of liquid or gaseous fuels. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large lower drum—30-inch diameter—permits a simple, symmetrical tube arrangement . . . greater storage capacity . . . easy access for washing down or inspection. A centrifugal fan, which operates at low speed and is exceptionally quiet in operation, is standard equipment. The simple baffle arrangement results in low draft loss . . . simple soot blowing . . . no dead pockets . . . high heat absorption. The VP is enclosed in a reinforced, gastight, welded steel casing, and shipped completely assembled with firing equipment, fittings and forced draft fan. For foundation, it needs only a simple concrete slab.



The C-E Vertical-Unit Boiler, Type VU-10

The VU-10 is available in nine sizes from 10,000 to 60,000 pounds of steam per hour . . . for design pressures up to 475 psi . . . up to 200 degrees of superheat available in 20,000-60,000 lb range . . . for solid, liquid, or gaseous fuels. This boiler is a completely standardized design adaptable to many conditions. Like the VP Boiler the VU-10 is particularly well suited to plants having small operating and maintenance forces. It is bottom-supported and needs no outside supporting steel. It performs efficiently over a wide range of output, and is easy to operate and to maintain. All parts are easily accessible for inspection. The VU-10 is a complete unit—boiler, furnace setting, fuel-burning equipment, controls, forced draft, heat recovery equipment (if desired). Regardless of fuel or method of firing, the same general cross-sectional arrangement of drums, convection bank and furnace wall cooling is used.

Dearborn®

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DEARBORN CHEMICAL COMPANY • MERCHANDISE MART PLAZA • CHICAGO 54, ILL.

what's wrong with H_2O?

Nothing...except that it's so rarely found in its pure state. Even rain, nature's closest approach to pure water, contains carbon dioxide and dissolved oxygen. So it is, in varying degrees, with every surface or underground water supply. All waters have certain corrosive impurities that must be corrected or neutralized before they can be economically used. There's where we come in.

Since 1887, Dearborn has worked with water to make water work better and more economically for you. That's why, today, industrial and commercial businesses of every size and type look to Dearborn for consultation and assistance in—

- ★ **Internal or external feed water treatment**
- ★ **Steam purity control**
- ★ **Feeding, softening or de-ionizing equipment**
- ★ **Cooling water or process water treatment**
- ★ **Water reclamation**
- ★ **Treating industrial waste**

This broad experience of Dearborn's is available to you. Your Dearborn Water Treatment Engineer will gladly explain the advantages of Dearborn Supervisory Service—a program in which you use only the amount of service you need.

Why not investigate? There's no obligation.

MAIL THE COUPON!

Dept. PO

Dearborn Chemical Company
Merchandise Mart Plaza, Chicago 54, Illinois

☐ Please furnish more information on Dearborn Water Conditioning

☐ Have a Dearborn Water Treatment Engineer call

Name.....*Title*.....

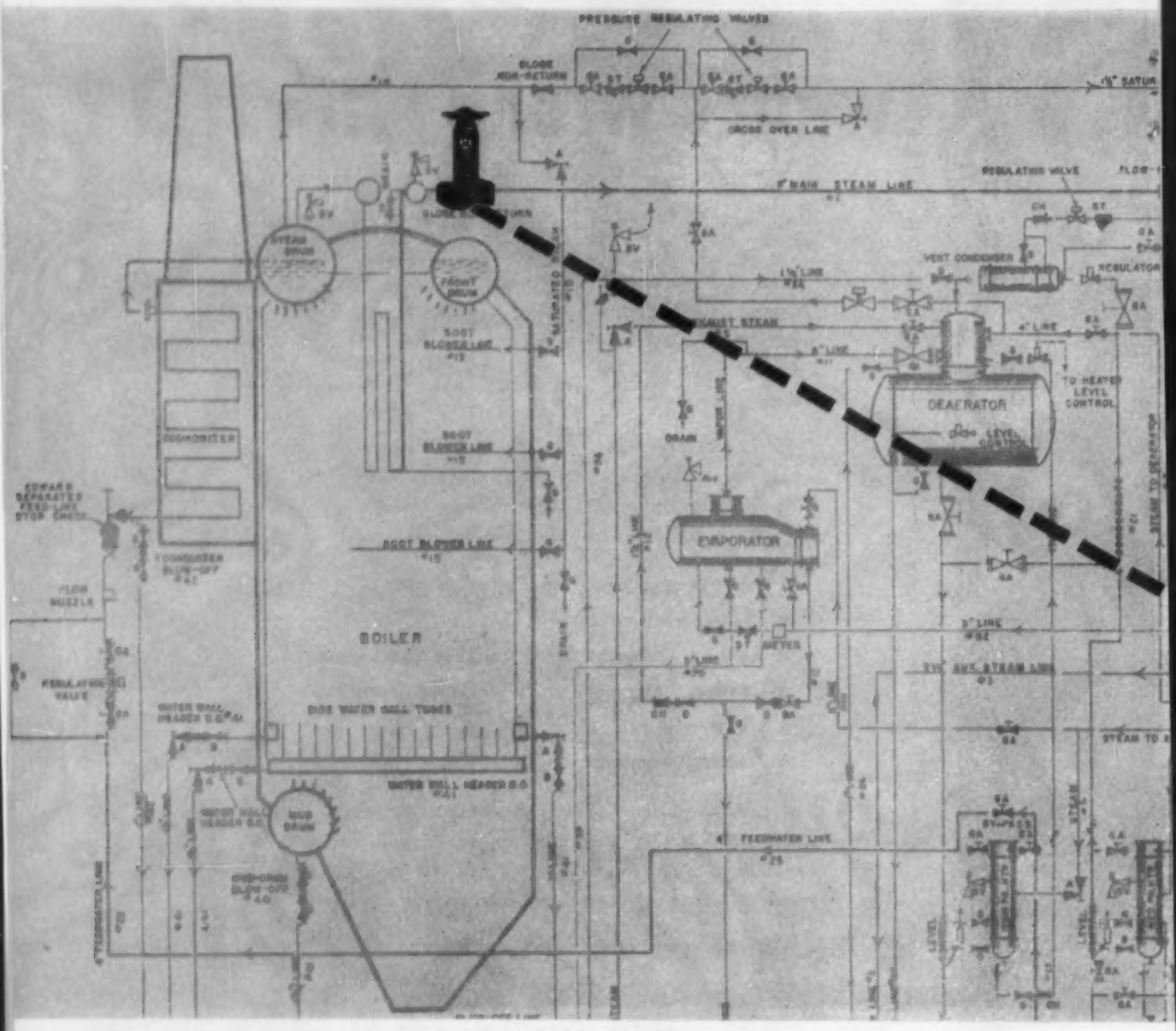
Company.....

Address.....

City.....*Zone*.....*State*.....

NON-RETURN VALVES

What you should know about



Essential to boiler safety is a non-return valve, required to prevent flow of steam from the main header into a boiler which is temporarily below header pressure. Edward non-return valves are installed on an overwhelming majority of the nation's principal power plant boilers.

BOILER CODE REQUIREMENTS

When two or more boilers are connected to a common header, the steam connection from each boiler must be fitted with two stop valves, preferably consisting of one automatic non-return valve set next to the boiler and a second valve of the outside screw and yoke type.

The non-return valve must be rated:

1 At 100% of the set pressure of the drum safety valve at the corresponding saturated steam temperature.

2 At 100% of the minimum set pressure of the super heater safety valve at the super heated steam temperature.

3 At 85% of the lowest set pressure of the boiler drum safety valve at the expected temperature at the super heater outlet.

Reference P 302, P 303, Rules for Construction of Power Boilers, 1952.

INSTALLATION POINTERS

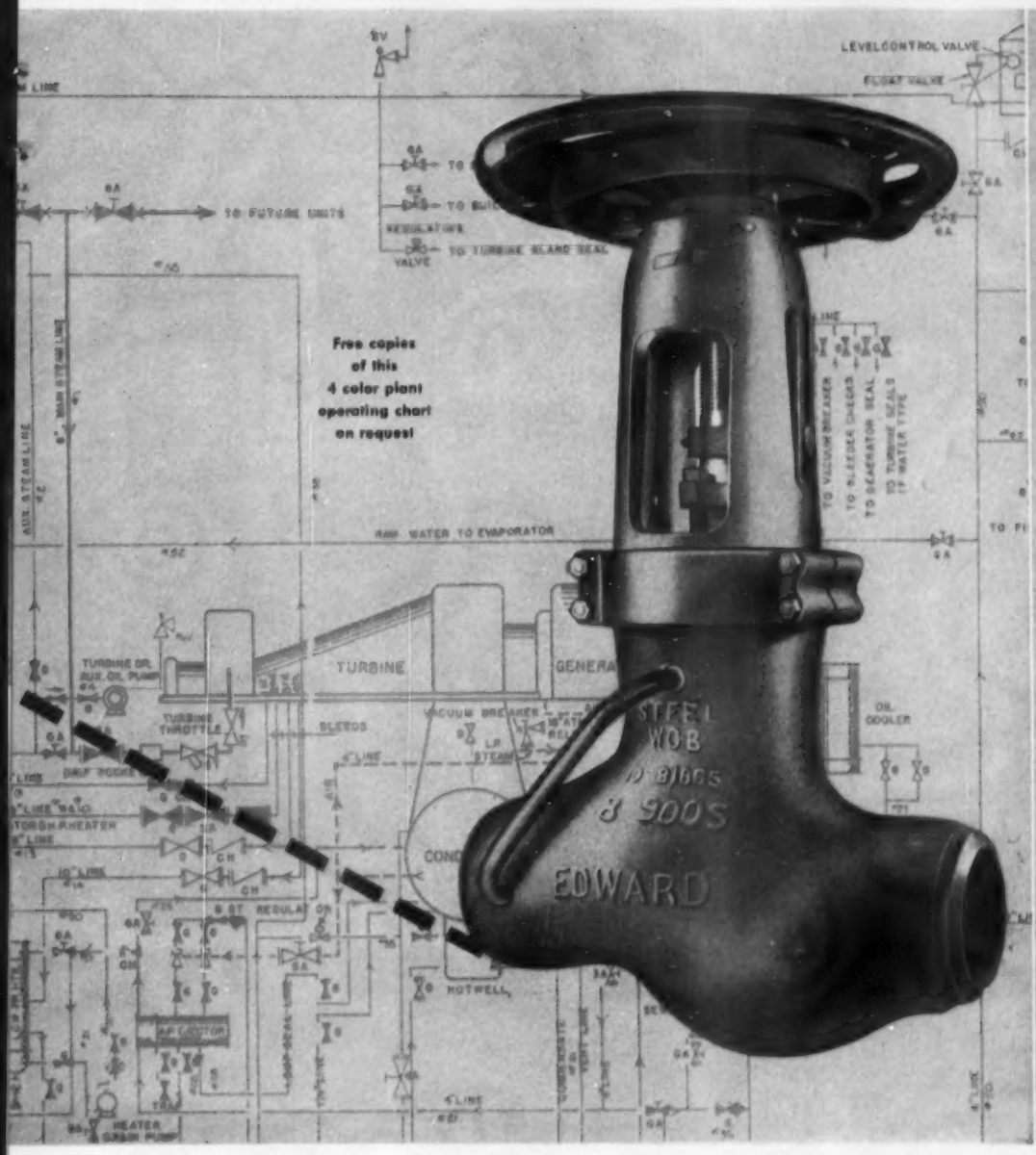
The non-return valve should be installed:

1 So that it can be readily manipulated by hand as a stop valve.

2 So that the disk piston is in a vertical plane. Avoid installations where the disk piston travels on an angle, thus providing the possibility of hang-ups and incomplete closure.

3 With an Equalizer, where operating conditions require wide variations in flow rates. The Equalizer, a piping connection between the high pressure area over the disk piston and the low pressure, high velocity outlet, causes the disk piston to be sucked up into the bonnet chamber, which gives it a firm support and provides vibrationless operation. The flow passages in the valve are left wide open for minimum pressure drop.

NON-RETURN VALVES*



4 On the boiler lead just after the superheater safety valve. An Edward gate valve is recommended as the second stop valve required by the boiler code which also stipulates that a drain must be installed between the two valves so that its discharge is visible while the operator is manipulating the valve.

SELECTION POINTERS

Be sure your non-return valve has:

1 A simple uncomplicated design—avoid gadgety constructions and involved mechanisms which can cause trouble and fail in operation.

2 A closing mechanism which insures drop tight closing at boiler test pressures. A great asset here is the Edward Impactor Handwheel which allows an operator to apply 2.8 times the closing force of ordinary handwheels.

3 Forged stainless steel piston rings. Insistence on forged rings will eliminate disassembling of valve to remove pieces of broken piston rings from the flow passages.

4 Body contours which have been specifically designed and tested for minimum pressure drop.

5 Integrally cast mirror smooth guide ribs, which govern the path of the disk piston during its entire travel. Stem guided disk pistons may cause faulty alignment during the last stages of travel, the most critical part.

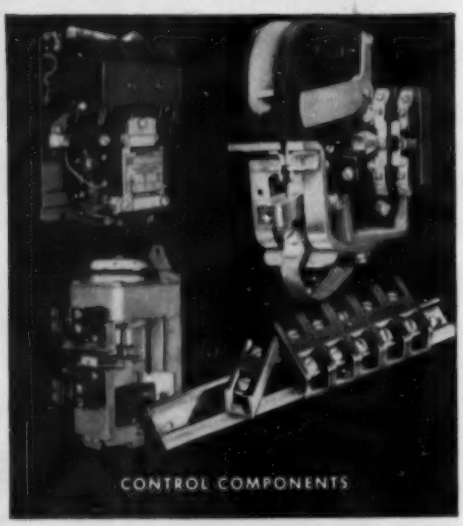
6 Light weight disk piston of hourglass design for maximum piston lift and low pressure drop.

For complete information on non-return valves write for a copy of catalog 12-B to Department NR, Edward Valves, 1200 West 145th St., East Chicago, Indiana.

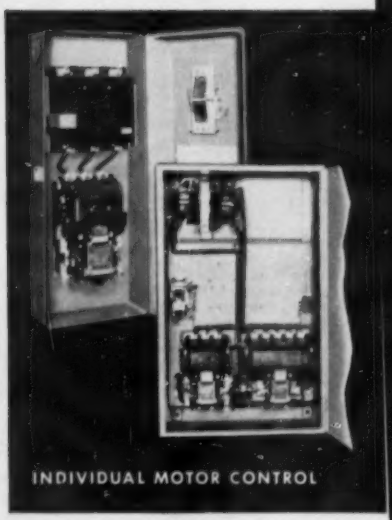
*One of a series providing condensed information on valve applications in steam power plants.

Edward Valves, Inc.
Subsidiary of ROCKWELL MANUFACTURING COMPANY
1230 W. 145th STREET
EAST CHICAGO, INDIANA
Another Product

MOTOR CONTROL FACTS ON
INDUSTRY'S MOST COMPLETE LINE



CONTROL COMPONENTS



INDIVIDUAL MOTOR CONTROL

FACT:

The only manual reduced voltage starter with air break contacts in all ratings

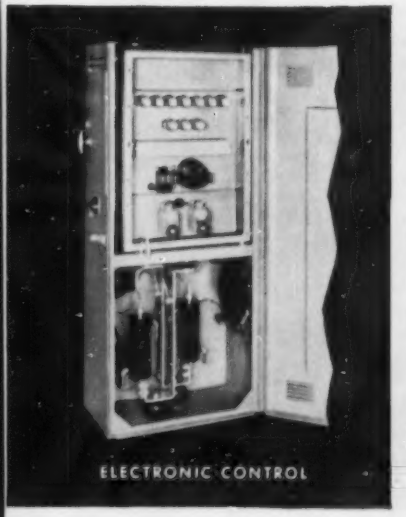
The new Westinghouse Type MB autostarter with air break double contacts eliminates the costly "oil problems" of contamination, oil level checks, spilling and messy leaking. This combined with timed acceleration makes it industry's most advanced reduced voltage starter.

Such product design advances are just part of the total advantages you gain with Westinghouse motor control. *Whatever your control problem* —from the simplest control component to complete automation—it can be solved all from *one* source—*one* responsibility.

For *all* the facts on Westinghouse motor control, call your Westinghouse sales engineer . . . *The Man With The Facts!* J-21872

YOU CAN BE SURE... IF IT'S

Westinghouse



ELECTRONIC CONTROL

CONTROL SYSTEMS

MANUFACTURING, ENGINEERING AND APPLICATION FACILITIES

DE LAVAL *offers a wide range*

When you specify De Laval equipment for power house service, you can be sure of sound engineering design and quality manufacturing... from quiet, pulsation-free De Laval IMO pumps to high pressure De Laval barrel type boiler feed pumps. • De Laval equipment stays on the line for years... requires a minimum of maintenance.

BOILER FEED PUMPS

Furnished in a variety of designs and sizes to meet any boiler feed service.

BARREL TYPE

for boiler pressures of 1,000 psi and above. Send for De Laval Bulletin 1506.

MULTI-STAGE OPPELLER

for feeding boilers operating at 250 to 1,000 psi. Send for De Laval Bulletin 1502.

SINGLE AND TWO-STAGE

for boiler pressures 250 psi and below. Send for De Laval Bulletin 1501.

TURBINE GENERATORS

Up to 11,500 kw. Available in automatic extraction designs. Send for De Laval Catalog 4200A.

MECHANICAL DRIVE TURBINES

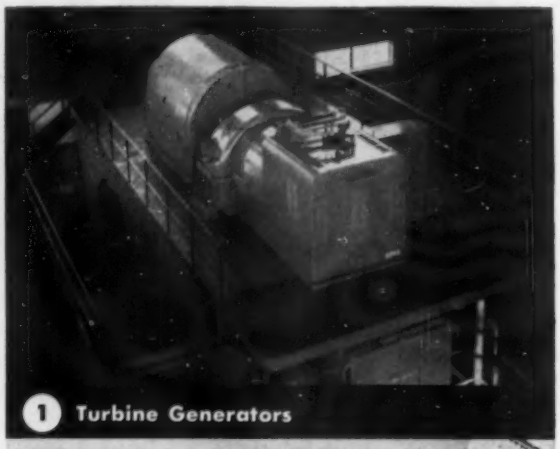
For induced and forced draft fan drives, condensate, circulating and boiler feed pump drives. De Laval HCB Turbines handle pressures up to 300 psig and temperatures to 550F, back pressures to 25 psig, for hp to 100. De Laval CA Turbines are designed for pressures to 900 psig and temperatures up to 900F, back pressures to 300 psig, for hp to 2,500. Send for De Laval Bulletins 4202 and 4206R.

DE LAVAL IMO PUMPS

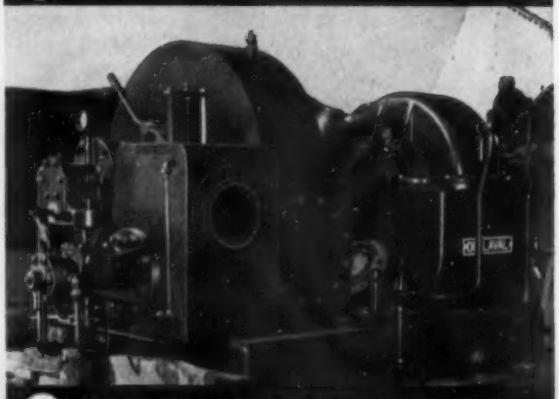
For fuel oil burner supply and transfer as well as lube oil services. Available in capacities to 750 gpm, pressures to 1,000 psig. Send for De Laval Catalog LS.

SINGLE STAGE, DOUBLE SUCTION CENTRIFUGAL PUMPS

Used for condenser circulating and general services. These pumps are available in capacities from 50 to 75,000 gpm. Send for De Laval Bulletins 1002 and 1004.



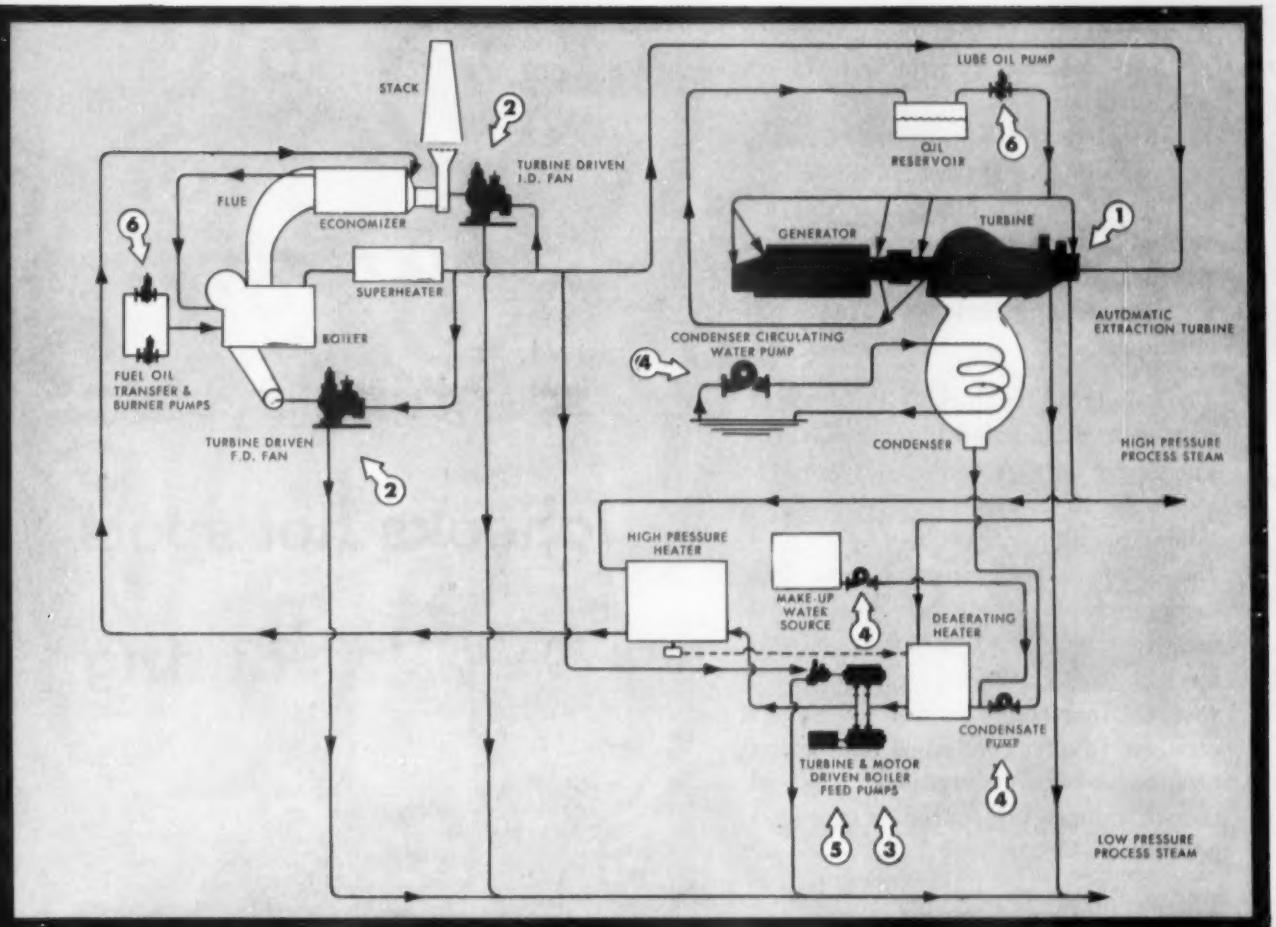
1 Turbine Generators

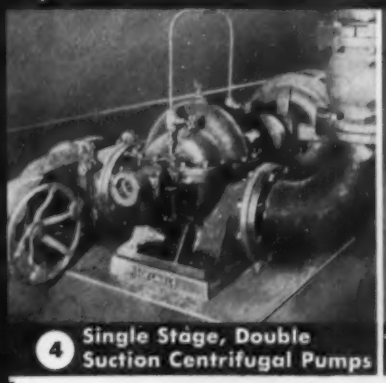


2 Mechanical Drive Turbines

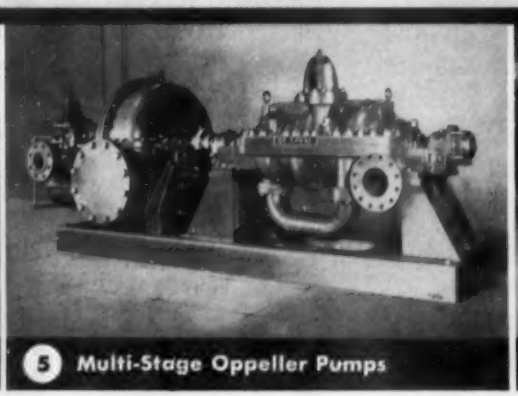
3 Barrel Feed Pumps

of power plant equipment

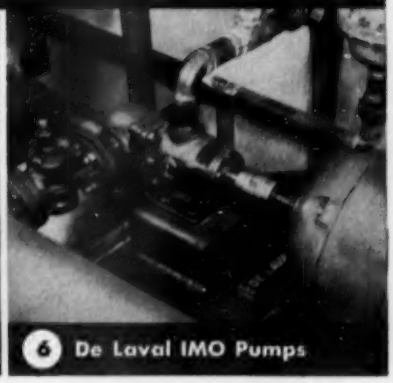




4 Single Stage, Double Suction Centrifugal Pumps



5 Multi-Stage Oppeller Pumps



6 De Laval IMO Pumps

DE LAVAL *Steam Turbine Company*

815 Nottingham Way, Trenton 2, New Jersey

OL 302

Practical service training at Honeywell's school . . .

makes your instrument men more valuable

Your instrument maintenance men can get a real education in the most up-to-date methods for servicing instruments, at Honeywell's Training School. Any organization which uses Honeywell instruments can send maintenance personnel to this school. Tuition costs you nothing, for this school is maintained as a "plus-value" service to Honeywell customers.

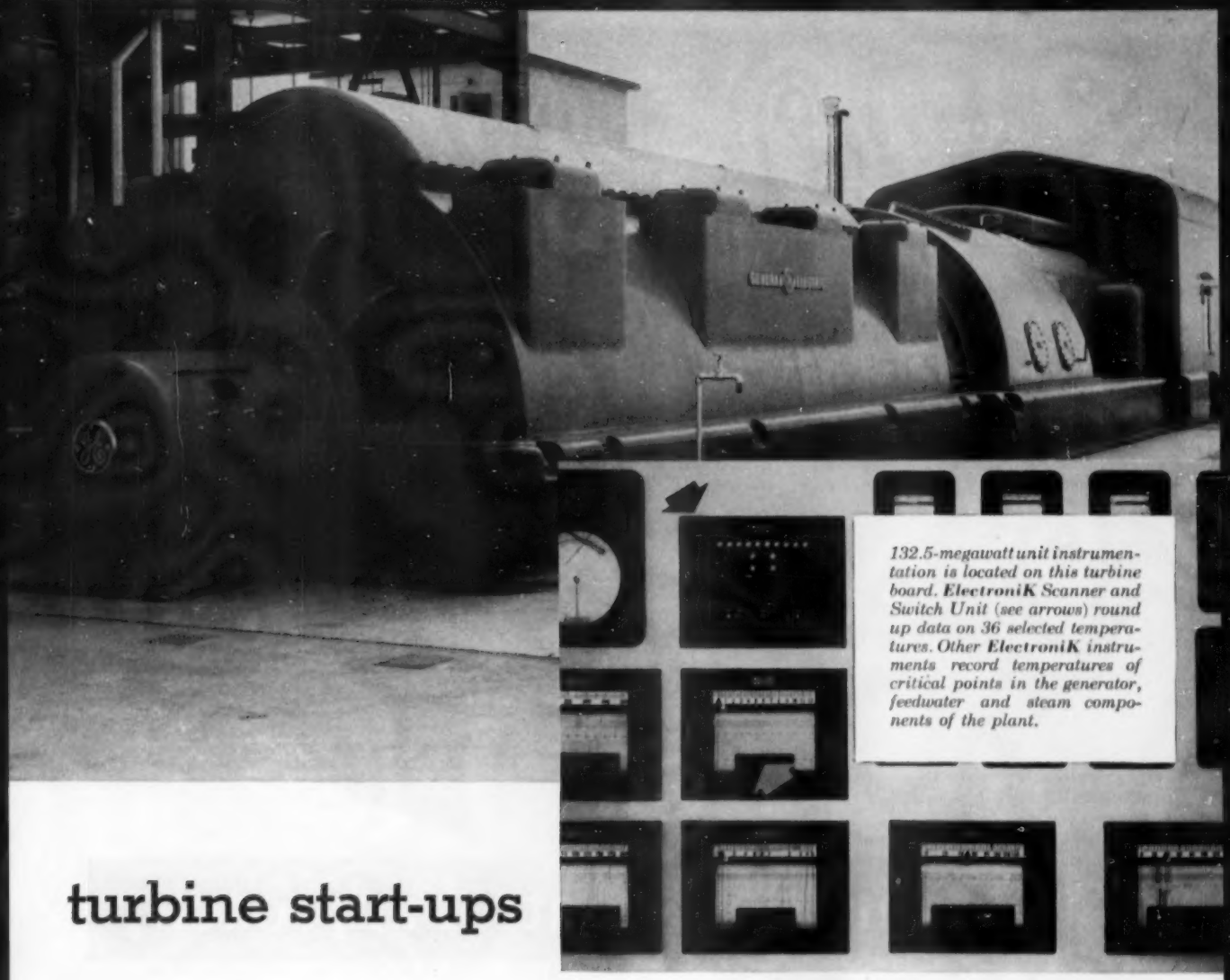
Thousands of technicians have either started or augmented their instrument knowledge here. A variety of courses is available, to fit men for the particular kind of maintenance problems they may encounter in their specific jobs. The comprehensive course . . . one of the most complete and intensive offered anywhere . . . covers about thirteen weeks. Other courses cover five weeks and less, to offer condensed instruction of either a basic or "refresher" nature to men who can't be spared for extended periods.

There's nothing academic about this school. The emphasis is placed on practical knowledge. Theory through lectures and textbook study is liberally supplemented by laboratory sessions and actual bench work on all types of instruments and related equipment.

One caution: classes have to be limited to assure thorough attention to all students, so make reservations in advance. Your local Honeywell office will be glad to make arrangements. Call today . . . it's as near as your phone.

*Electronik** scanning system checks hot spots during

The complete Honeywell line of instruments for power plant use is listed and described in Bulletin 90-2, "Supervisory Instruments for Power Generation." Write for your copy today.



132.5-megawatt unit instrumentation is located on this turbine board. ElectroniK Scanner and Switch Unit (see arrows) round up data on 36 selected temperatures. Other ElectroniK instruments record temperatures of critical points in the generator, feedwater and steam components of the plant.

turbine start-ups

AT THE Martins Creek station of Pennsylvania Power & Light the problems of getting a big generating unit on the line quickly and safely have been considerably simplified by *ElectroniK* instrumentation. During start-up of the station's 132.5-megawatt unit, operators can watch critical temperatures as a guide to maintaining safe operation . . . and at the same time, they can bring the unit under load in the shortest period.

A key instrument during start-up is the *ElectroniK* Scanner. Connected to 36 different thermocouples spotted at vital locations in the turbine, this instrument concentrates a lot of data useful to the operator. It switches rapidly through all 36 points in succession, indicating each temperature and identifying the points by means of coded signal lights. If any temperature exceeds a pre-set limit, the instrument automatically actuates an annunciator.

At the flip of a switch, the Scanner can be set to record all points whenever temperature limits are exceeded . . . to record all points continuously . . . to indicate only . . . or to record only manually selected points. Available also in models for as many as 270 points, the *ElectroniK* Scanning System provides accurate, flexible monitoring at a cost per point far lower than that available with conventional recording instruments. It saves panel space, too . . . for one instrument does the work of several.

Your local Honeywell sales engineer will be glad to discuss how the versatile line of *ElectroniK* instruments can be applied advantageously in your own plant. Call him today . . . he's as near as your phone.

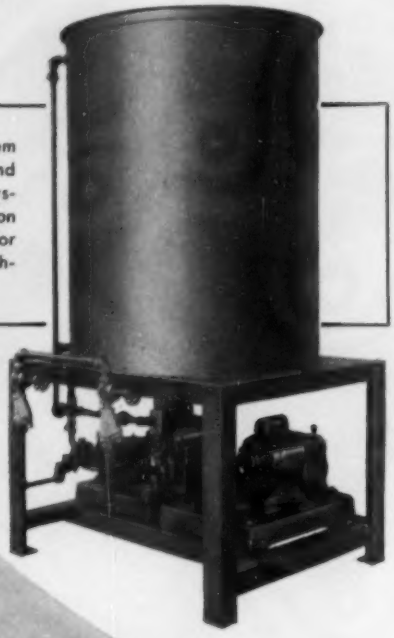
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA:**
Write for Data Sheet No. 10.0-9, *"ElectroniK* Scanning System," and for new Bulletin 9060 on Load and Frequency Control.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

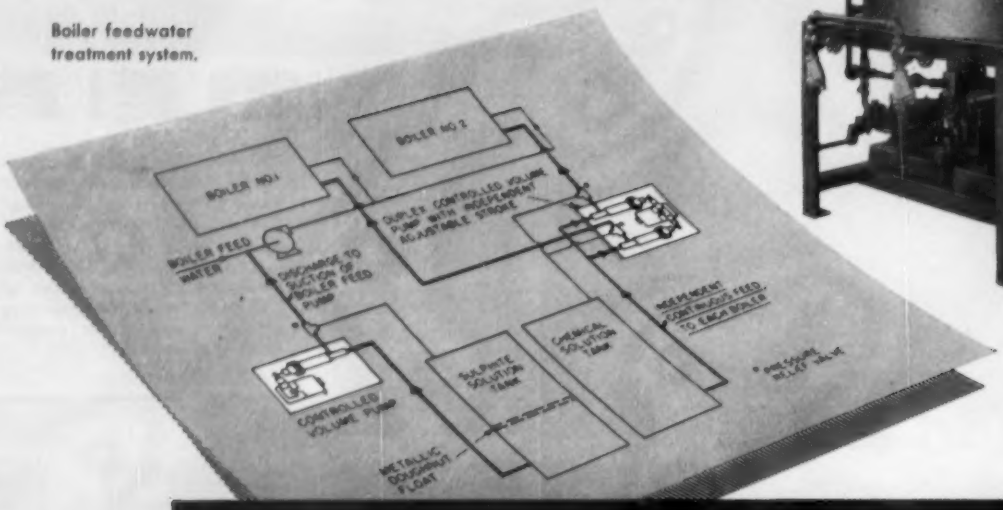
First in Controls

*Trade name of the Minneapolis-Honeywell Regulator Co.



Typical Milton Roy packaged system—comprising a chemical tank and two Controlled Volume Pumps. Systems supplied with chemical solution tanks up to 500 gal. capacity . . . for any boiler pressure . . . with or without automatic control.

Boiler feedwater treatment system.


BOILER NO. 1
BOILER NO. 2
BOILER FEED WATER
DISCHARGE TO SUCTION OF BOILER FEED PUMP
DUPLEX CONTROLLED VOLUME PUMP WITH INDEPENDENT ADJUSTABLE STROKE
CONTROLLED VOLUME PUMP
SULFITE SOLUTION TANK
CHEMICAL SOLUTION TANK
METALLIC DOUGHNUT FLOAT

this flow-control approach

cuts cost of boiler water treatment . . . boosts boiler and turbine life

REDUCED chemical costs, increased boiler and turbine life . . . result when treating chemicals are *accurately* metered in boiler water treating systems.

This simple packaged system, for example, provides an economical solution to the continuous treatment of boiler feed water. A simplex Controlled Volume Pump injects sodium sulfite directly into the reservoir of the deaerating heater, thereby removing residual oxygen and preventing pitting of economizers and boiler feed pumps. A duplex Controlled Volume Pump meters phosphate directly to the boiler drum of each of two boilers, thereby removing dissolved minerals and preventing scale formation in boiler tubes.

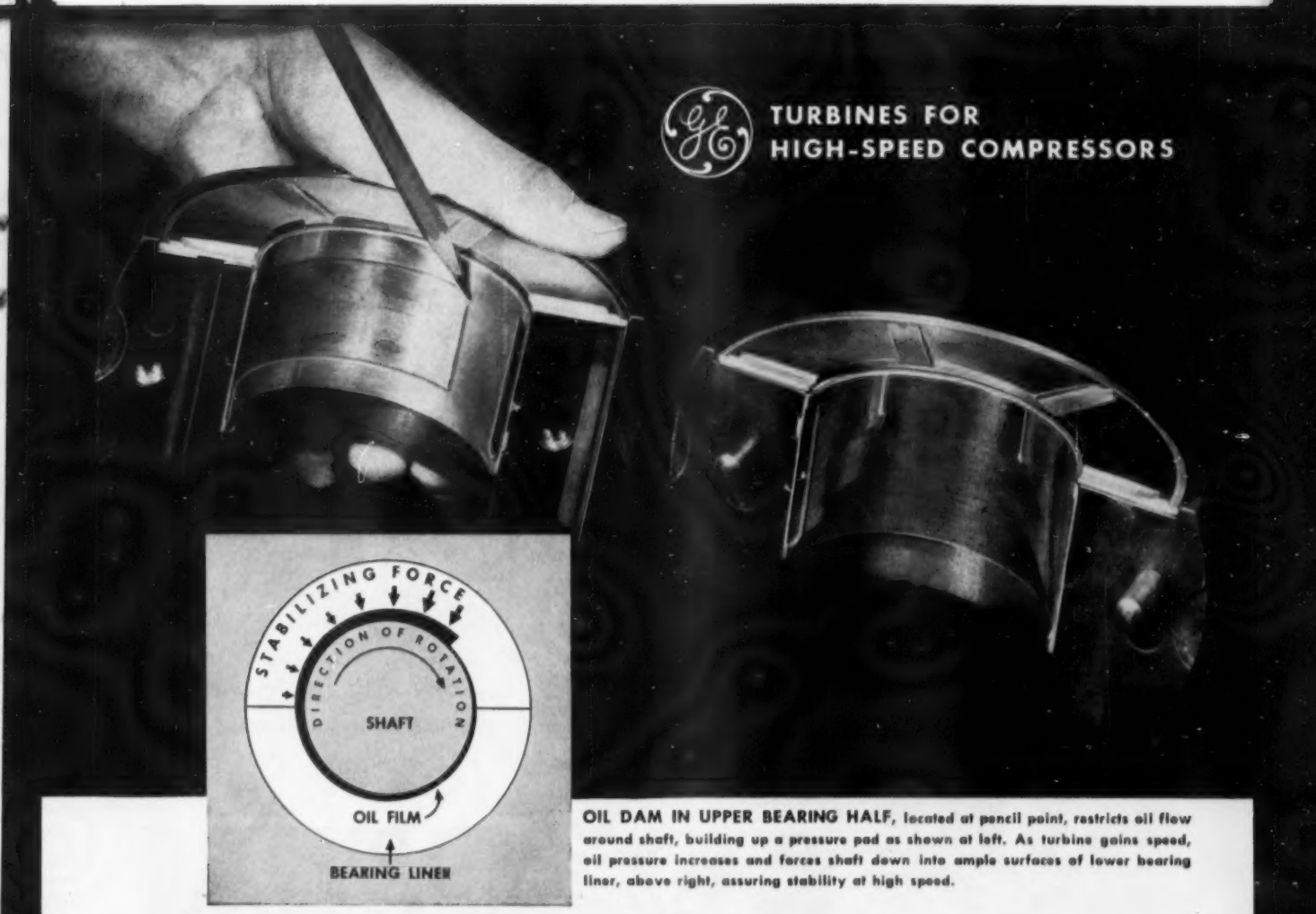
Milton Roy engineers and fabricates complete packaged systems for the treatment of boiler feedwater, with all necessary piping, valves, and liquid level gauge. Agitators, dissolving baskets, instrumentation, and alarms can also be furnished, as desired.

How can we serve you?

Write for technical information. Or, send your problem to Milton Roy Company, *Manufacturing Engineers*, 1300 East Mermaid Lane, Philadelphia 18, Pa.

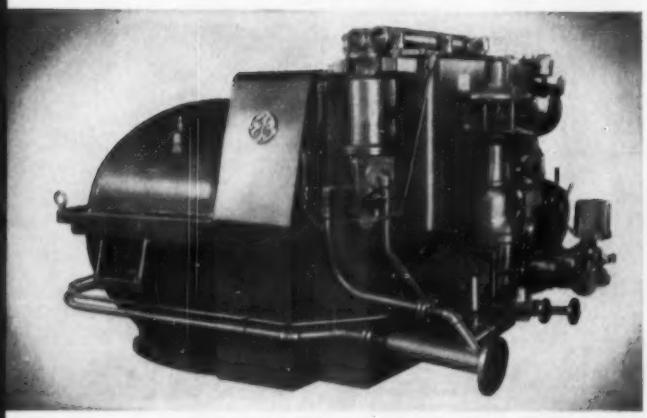
Engineering representatives in the United States, Canada, Mexico, Europe, Asia, South America, and Africa.

milton Roy
CONTROLLED VOLUME PUMPS



OIL DAM IN UPPER BEARING HALF, located at pencil point, restricts oil flow around shaft, building up a pressure pad as shown at left. As turbine gains speed, oil pressure increases and forces shaft down into ample surfaces of lower bearing liner, above right, assuring stability at high speed.

Large pressure-pad bearings add years of life to G-E high-speed turbines



TYPE DRV HIGH-SPEED MECHANICAL-DRIVE TURBINE

To provide longer, more reliable service, all G-E high-speed turbines incorporate large pressure-pad bearings. The generous surfaces of the bearings assure low unit loading for ample lubrication and minimum wear during start-up.

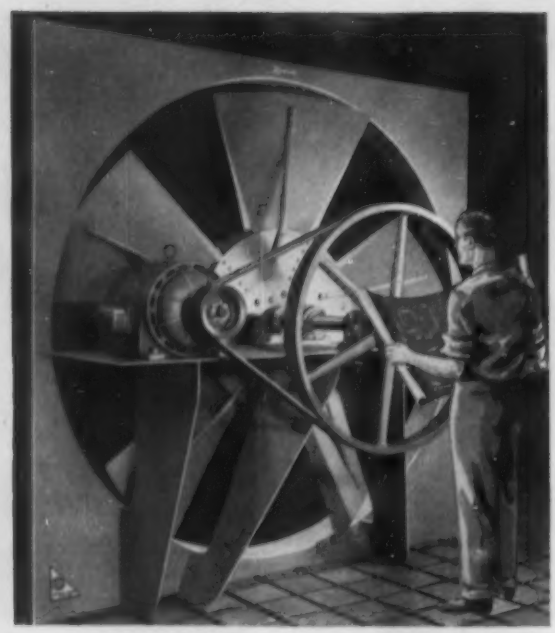
As turbine speed increases, the viscous pump action of the shaft carries oil into the cavity, building up a pressure pad. This forces the shaft down into the lower bearing half, thus minimizing the possibility of vibration, with its detrimental effect on bearing and packing life.

This is only one of many design features that make a G-E high-speed turbine your most reliable drive for compressors and blowers. For more information contact your nearest G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y. In Canada, contact Canadian General Electric Company, Limited, Toronto. 241-1

Progress Is Our Most Important Product

GENERAL ELECTRIC

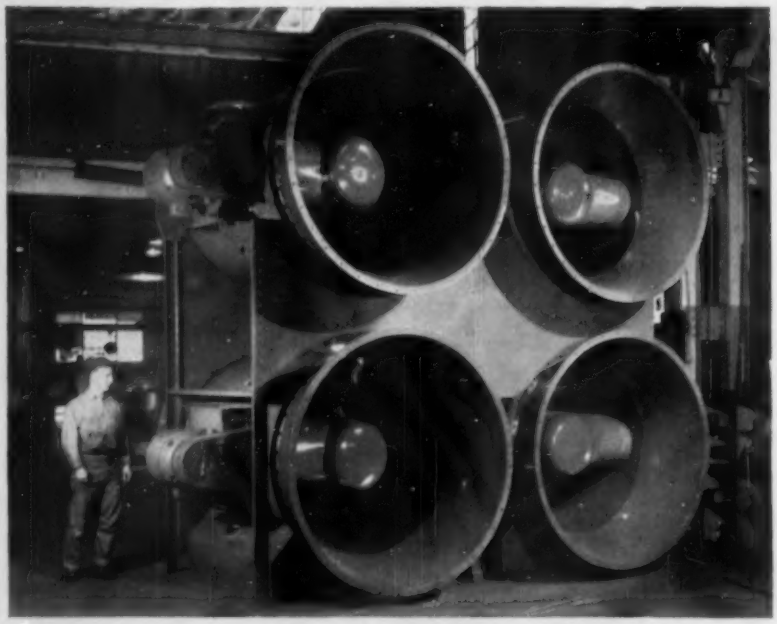
YOU DON'T NEED TO BROIL IN THE BOILER ROOM!



"BUFFALO" PACKAGE PROPELLER FANS are giving excellent results in removing excess heat from boiler rooms of large utility stations and industrial power plants — efficiently "moving out" large volumes of hot air to make boiler rooms cool, pleasant places to work in. The large 96" Package Propeller Fan shown is typical of the unusual efficiencies in this popular "Buffalo" line. Moving 80,000 cfm at ¼" static, it requires only a 15 H.P. motor. These fans operate against as high as 1" pressure, and sizes range up to 144" (this 12-foot wheel delivering 250,000 cfm!). For the economical answer to boiler room cooling, write today for BULLETIN FM-1234.

"BUFFALO" AXIAL FLOW FANS, too, are becoming increasingly popular with power plant operators because of their extremely high efficiency, light weight and suitability for duct mounting. If practical, heated air from the boiler room may be distributed to other areas by duct. These fans have the "Limit-Load" horsepower characteristic — they cannot be overloaded. At right is a 4-fan "package" unit now effectively cooling a prominent power plant. WRITE FOR BULLETIN 3533-C. In all "Buffalo" Fans, you get a built-in value known as the "Q" Factor* — the product of 78 years of air handling experience.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*



"BUFFALO" ALSO BUILDS the Induced Draft, Forced Draft, Primary Air, Gas Recirculating and other Fans that are helping to produce economical power for many of the country's best-known installations. WRITE FOR BULLETIN 3750.

"Buffalo"

BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, N. Y.

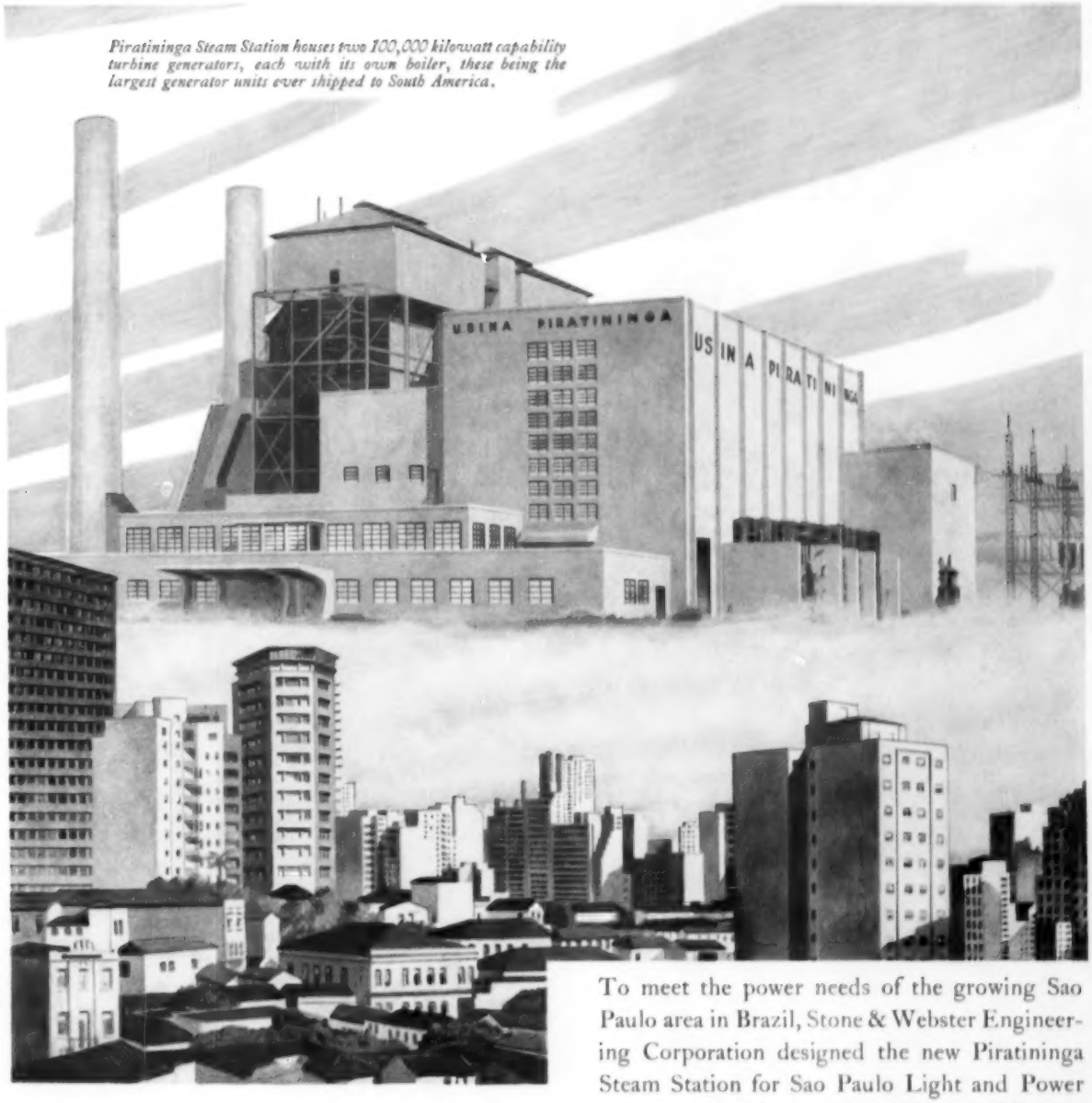
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ontario

Sales Representatives in all Principal Cities

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

GENERAL ELECTRIC



Piratininga Steam Station houses two 100,000 kilowatt capability turbine generators, each with its own boiler, these being the largest generator units ever shipped to South America.

ACHIEVEMENT IN BRAZIL . . .

To meet the power needs of the growing Sao Paulo area in Brazil, Stone & Webster Engineering Corporation designed the new Piratininga Steam Station for Sao Paulo Light and Power Company, Limited, an operating subsidiary of the Canadian corporation, Brazilian Traction, Light & Power Company, Limited. Construction for the first unit, now in operation, was completed in a record time of 26 months by Stone & Webster Construction Company.

All available materials were purchased in Brazil, and the field forces, totaling over 1800 at the peak of construction, were recruited locally.

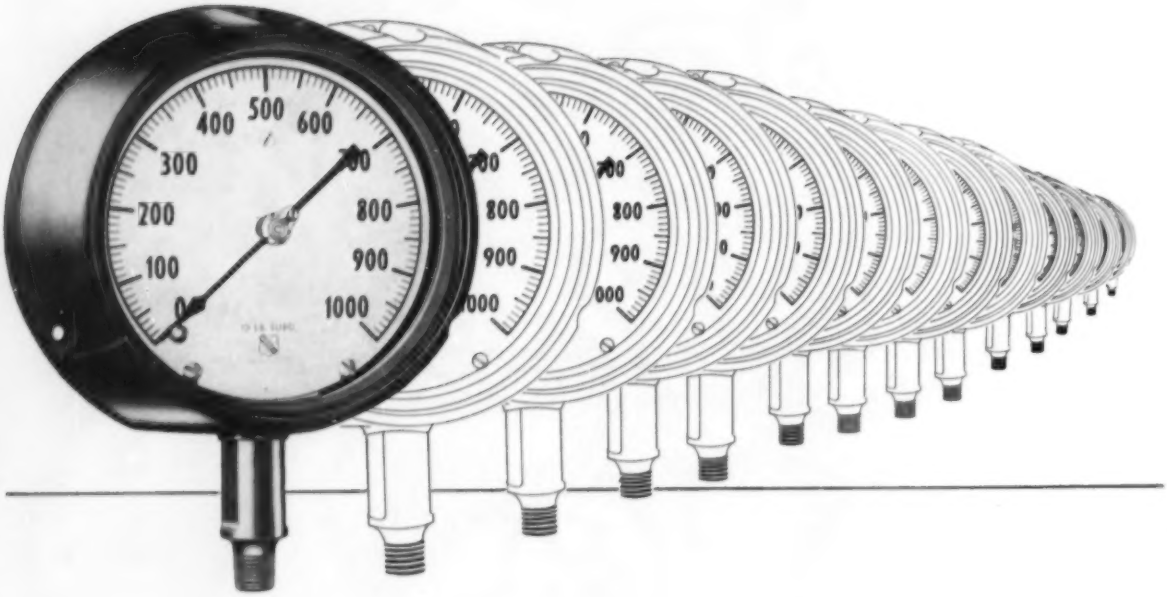
Write or call us for detailed information as to how our engineering, design, construction, report and appraisal services may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

SATISFACTION MULTIPLIED
3 x 8 x 8 x 38 x 2 x 5



Service Conditions primarily determine the pressure gauge you specify for your installation. The wrong gauge can cost time, trouble, and money.

That's the big reason why Ashcroft Duragauges make sure of your complete satisfaction by offering a multiple choice in case designs and materials, Bourdon tube materials, ranges, movements, and dial sizes. Briefly, you can select the right gauge for your requirements from:

Cases of 3 different materials in 8 service-proved designs.

Bourdon Tubes of 8 different types of metals to meet specific service requirements.

Pressure Ranges from 30" vacuum or a few ounces through 100,000 psi.

Rotary Geared Movements that include the famous "Nylon Movement" or all stainless steel.

Dial Sizes from 4½" through 12".

Most important, Ashcroft Duragauges provide that unbeatable combination of highest sustained accuracy and durability of any pressure gauge built.

TAKE ADVANTAGE of the counsel of your nearby Industrial Supply Distributor. You can count on him to help you select Ashcroft Duragauges that will serve better and longer, with minimum maintenance, no matter how severe the conditions of vibration, pulsation, corrosion and weather.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

a *Heyl & Patterson* contribution to Improved Efficiency in the Modern World of Power

1100 Ton Per Hour Capacity Coal Barge Unloaders

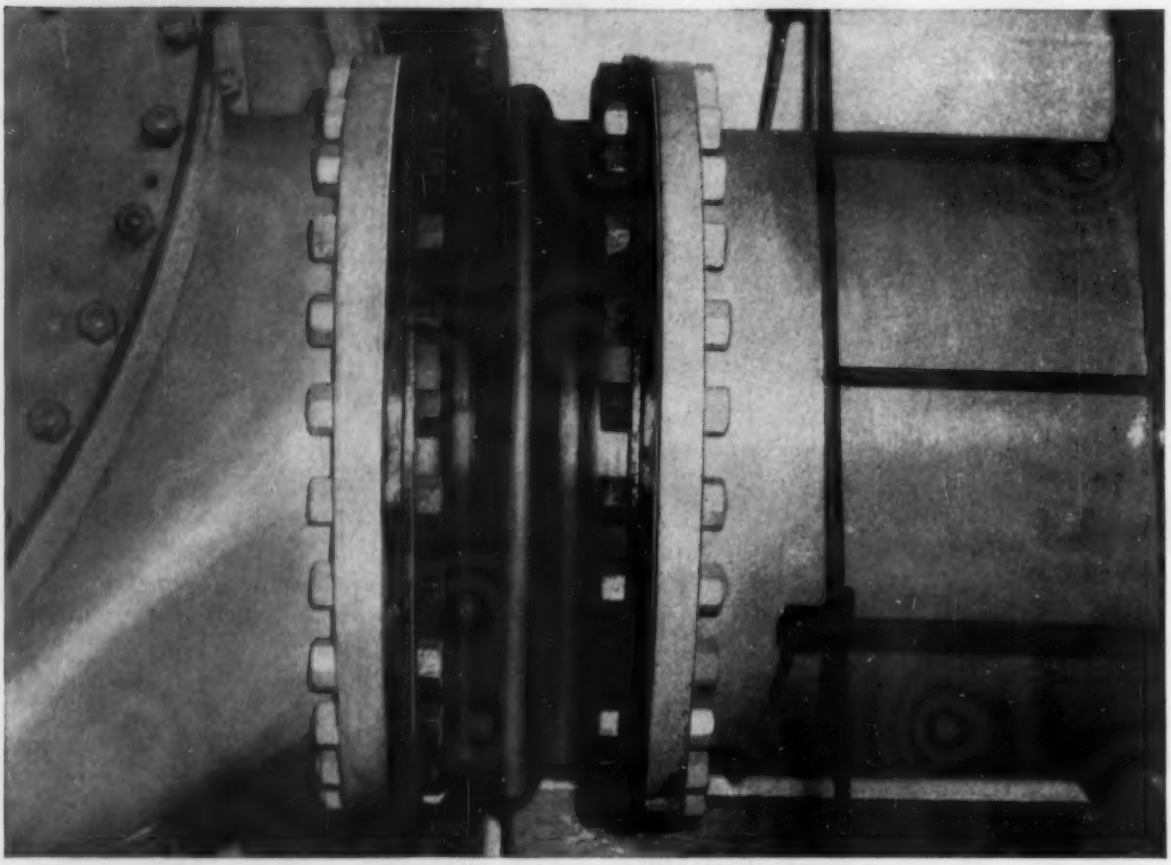
THE PICTURE SHOWS . . . A New Coal Barge Unloader at The Kyger Creek Power Plant of The Ohio Valley Electric Corporation.

It was Designed, Built and Erected by Heyl & Patterson. It removes coal from river barges to a 200-Ton Capacity Receiving Hopper built integrally in the Unloader. The coal flows from the hopper by gravity to a 54" Belt Feeder, then to a 48" Belt Conveyor which delivers it to the Power Plant Bunkers. Every Sales Representative of the Heyl & Patterson Staff is an experienced engineer. Their services are available to you without obligation.

Boat Loaders and Unloaders
Cyclone Thickeners
Coal Handling Equipment
Thorsten Coal Samplers
Coal Storage Bridges
Rotary Car Dumpers
Bradford Breakers
Reineveld Centrifugal Dryers

Heyl & Patterson, Inc.
"SINCE 1887"
55 FORT PITT BLVD. PITTSBURGH 22, PA.

28 years old... but there's a lot of life in the old joint!



Back in 1926, this 30" x 12" U.S. Expansion Joint was installed in a Louisiana power plant. This rubber joint is still in fine working condition. Age has not impaired its efficiency. Three other U.S. Joints in this plant are the same age, are still performing well... and one of them has been used continuously in the valve end inlet header water circulation line in a *very moist location*. Our service engineers report it has many more years of fine service still ahead!

In United States Rubber Company's Expansion Joint Line are standard types to meet the majority of general industrial requirements on pressure or vacuum lines—insulating against vibration, compensating for expansion or contraction. Joints can also be designed and built to meet your own specifications. You can always rely on U.S. Expansion Joints to lengthen the life of equipment, save many times their original cost.

Get in touch with any of United States Rubber Company's **27** strategically located District Sales Offices, each staffed with engineers to serve you, or write to address below.

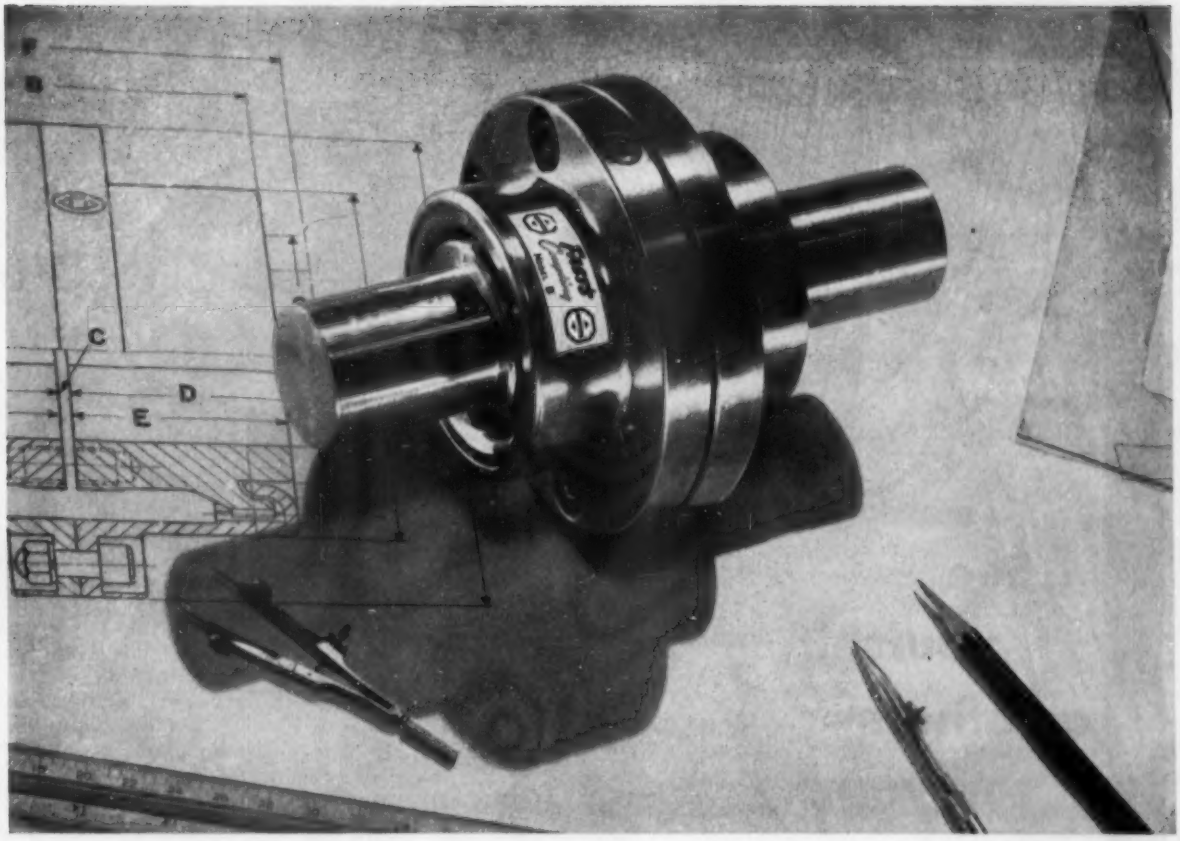
US RUBBER

"U.S." Research perfects it
"U.S." Production builds it
U.S. Industry depends on it

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting



Now for the first time, a Fast's Coupling for light and medium drives—at a new low cost!

It's the new Fast's Coupling MODEL B—a lighter, smaller coupling with all the famous Fast's features never before available at such a low cost!

The new MODEL B fills the needs of manufacturers of fans, blowers, pumps and other light-to-medium drive units where coupling *cost* is as important as performance. Koppers engineers designed it to eliminate the cost barrier and offer Fast's rugged design and trouble-free performance for hundreds of new applications.

All steel, dust and moisture proof with metal-to-metal seal, Fast's MODEL B is available for shaft sizes up to 2⅝". Like all Fast's Couplings, it's *sold with service* . . . Koppers *free* engineering service that guarantees the right coupling for the job.

The new Fast's MODEL B Coupling may offer a profitable solution to your light or medium drive coupling problems. Find out how by writing for full details to: KOPPERS COMPANY, INC., Fast's Coupling Dept., 224 Scott St., Baltimore 3, Md.

THE ORIGINAL **FAST'S Couplings**

KOPPERS

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • BALTIMORE, MD. This Koppers Division also supplies industry with American Hammered Industrial Piston and Sealing Rings, Koppers Electrostatic Precipitators, Aeromaster Fans and Gas Apparatus. Engineered Products Sold with Service

KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 224 Scott St., Baltimore 3, Md.
Gentlemen: Please send me more detailed information on the new Fast's Coupling MODEL B.

Name.....

Company.....

Address.....

City.....Zone.....State.....

Capsule Case History:

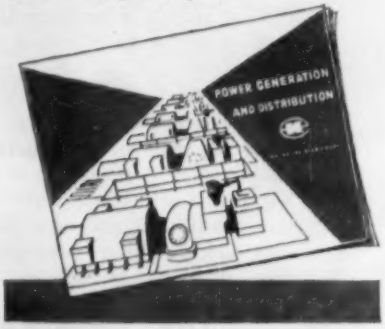
See yourself as others see you...

Many major firms have employed Kaiser Engineers to analyze their present problems and appraise future needs and prospects. Kaiser Engineers is particularly well qualified to provide this fact-finding service, for it has a wide diversity of talents to prepare engineering and economic feasibility reports, market and site location studies.

To Purchase or Generate the power needed for large plants is a question requiring an answer based on thorough examination of a wide range of facts. Kaiser Engineers recently completed such a comprehensive comparative study for a major steel mill.

The KE team includes power specialists who are fully qualified to provide your firm with a complete analytical report covering the economic and engineering feasibility of your contemplated power installation.

The new KE power brochure (No. 104) will soon be available. Your copy will be mailed upon request.



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ENGINEERS K CONTRACTORS

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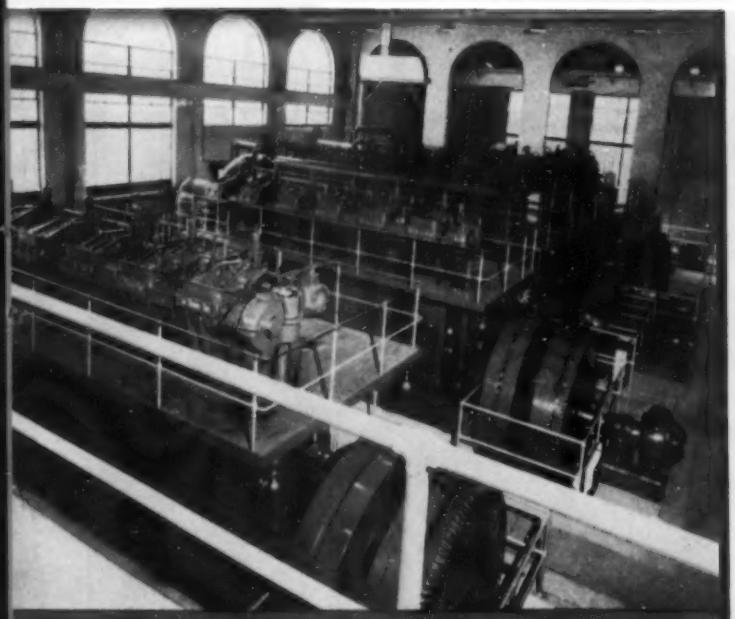


Maintenance of plant buildings and equipment make this light plant a showplace station of which Pierre residents are justly proud.

What Happens When STANDARD HD OIL Is Called In on a Ring Sticking Problem

In 1946, after experiencing considerable trouble with ring sticking, Pierre, S. D., Municipal Light Plant management decided to test STANDARD HD oil in their 2,000 hp. diesel engine. Result: nine years later and after 31,840 hours of operation the original fill of STANDARD HD oil is still in the diesel.

Plant Superintendent Floyd Halbert says engine cleanliness is what he values most. "Cleanliness of the oil is outstanding," he reports and says further, "There is almost no carbon, a minimum of cylinder wall wear and complete freedom from ring sticking. There has never been a bearing failure. Maintenance time for lubrication is zero."

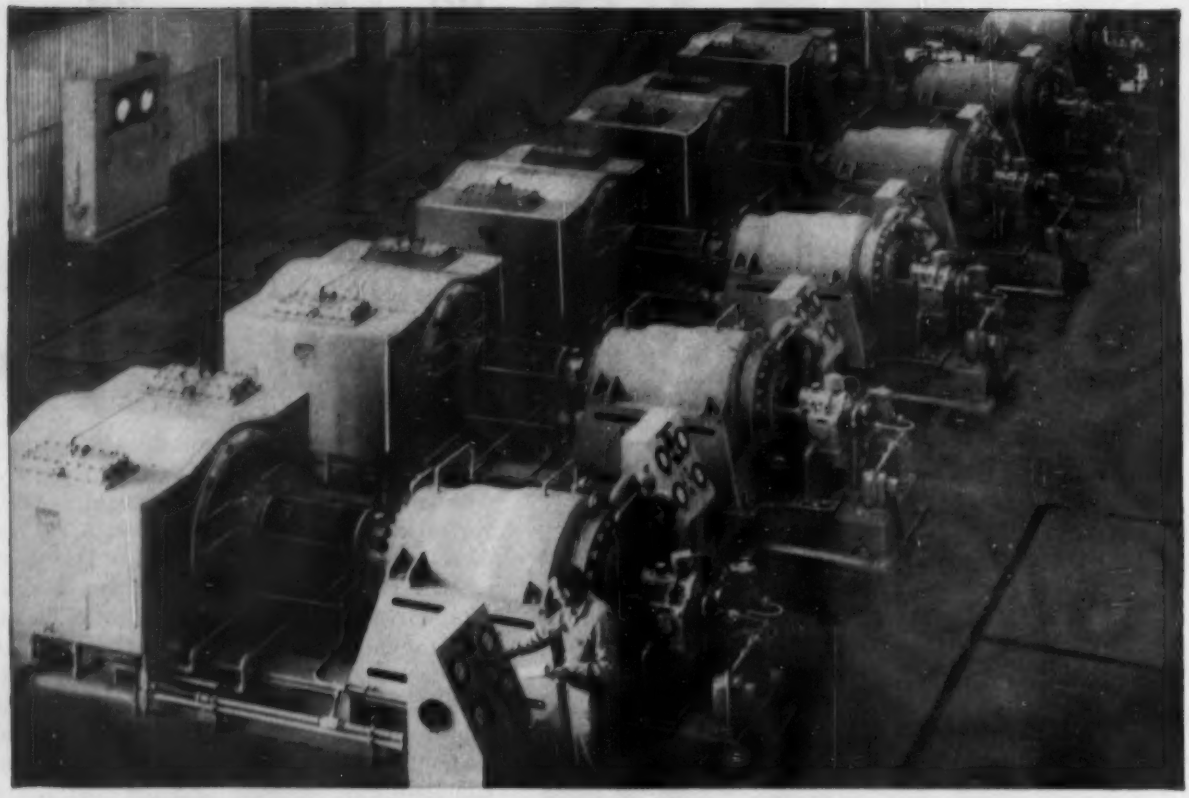
A typical record for STANDARD HD oil? Yes. STANDARD HD is helping many other plants establish new performance records, while setting new levels of engine cleanliness for old engines, and keeping new engines clean from the date of initial fill. Result: more and more folks with industrial lubrication problems like the one at Pierre, call for assistance from their Standard Oil lubrication specialist.

Perhaps you would like to find out more about STANDARD HD. In the midwest, call your nearby Standard Oil lubrication specialist. Or contact, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY
(Indiana)

STANDARD

In addition to the 2,000 hp. engine, Pierre plant has a 3,000 hp. and two smaller engines. All are lubricated with STANDARD HD Oil. Floyd Halbert (right), and Standard Lubrication Specialist Bob Kirk, go over Pierre plant operation sheet. Bob Kirk is an old hand at helping people solve lubrication problems. He's been doing this for Standard since 1943. Bob got his engineering training from the University of Washington. He has also completed the Standard Oil Sales Engineering School. Customers find this experience and training pay off for them.



SIX WORTHINGTON HIGH-PRESSURE BOILER FEED PUMPS on the job at the Contra Costa Steam Plant of the Pacific Gas and Electric Company. Each pump delivers 500,000# per hour at a discharge pressure of 1,800 psig.

What should you look for in a high-pressure* boiler feed pump?

We think we're qualified to answer that. Back in 1923 we built our first high-pressure centrifugal boiler feed pump, and we've had a lot of experience making them since.

Here are some of the features you should look for:

All pressure joints should be *metal-to-metal ring type joints*, universally accepted as the proper construction for high-pressure service.

Inner assembly should be firmly anchored to the casing barrel at the inboard end, but *free to expand* under temperature changes at the outboard end without destroying perfect centering of running joints and bearing support.

Internal joints constructed so that hydraulic pressure acts to seal joints, rather than open them. Only in pumps of this design can the tightness of the internal joints be hydraulically tested during the process of assembly.

Pump casing made of forged steel, the same material that is selected for all high-pressure fittings and valves.

Centerline support of casing should allow for temperature changes with minimum distortion.

"Volute-passage" diffuser to eliminate narrow diffuser passages and a multitude of diffuser vanes.

All of these, by the way, are standard on Worthington high-pressure boiler feed pumps. And our customers are pretty happy about it, too.

Ask for our Bulletin W319B-1C. Write Worthington Corporation, Centrifugal Pump Division, Harrison, New Jersey. *Over 1300 psi. C.3.12

SEE the Worthington Corporation Exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 41st Street.

WORTHINGTON

The World's Broadest Line Assures You the Right Centrifugal Pump for Every Job

Boiler Feed Normal Service • **Hotwell, Condensate, Chilled Water** • **Water Works, Circulation, Drainage, General** • **Boiler Feed High Pressure Service**

New Prudential Building to burn coal the modern way

Ultra-modern in all respects, the new 41-story building of the Prudential Insurance Company of America in Chicago incorporates the latest developments in design, fixtures and construction. This beautiful structure will be completely air-conditioned and will offer its occupants all possible conveniences.

Among those conveniences will be Prudential's heating system, as up-to-date as the building itself. This most modern building in the country will burn *coal.* Cleanly. Efficiently. And its completely automatic coal handling and burning installation will provide sure, even heat *economically* under all conditions.

Investigate Your Fuel Costs

If you're planning to modernize your plant or build a new one—or if you are just interested in cutting fuel costs—find out how coal, burned the modern way, compares to other fuels. Why not talk to a consulting engineer or your nearest coal distributor. Their advice may save you thousands of dollars each year.

facts you should know about coal

Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar.

Automatic coal and ash handling systems result in a virtually labor-free plant.

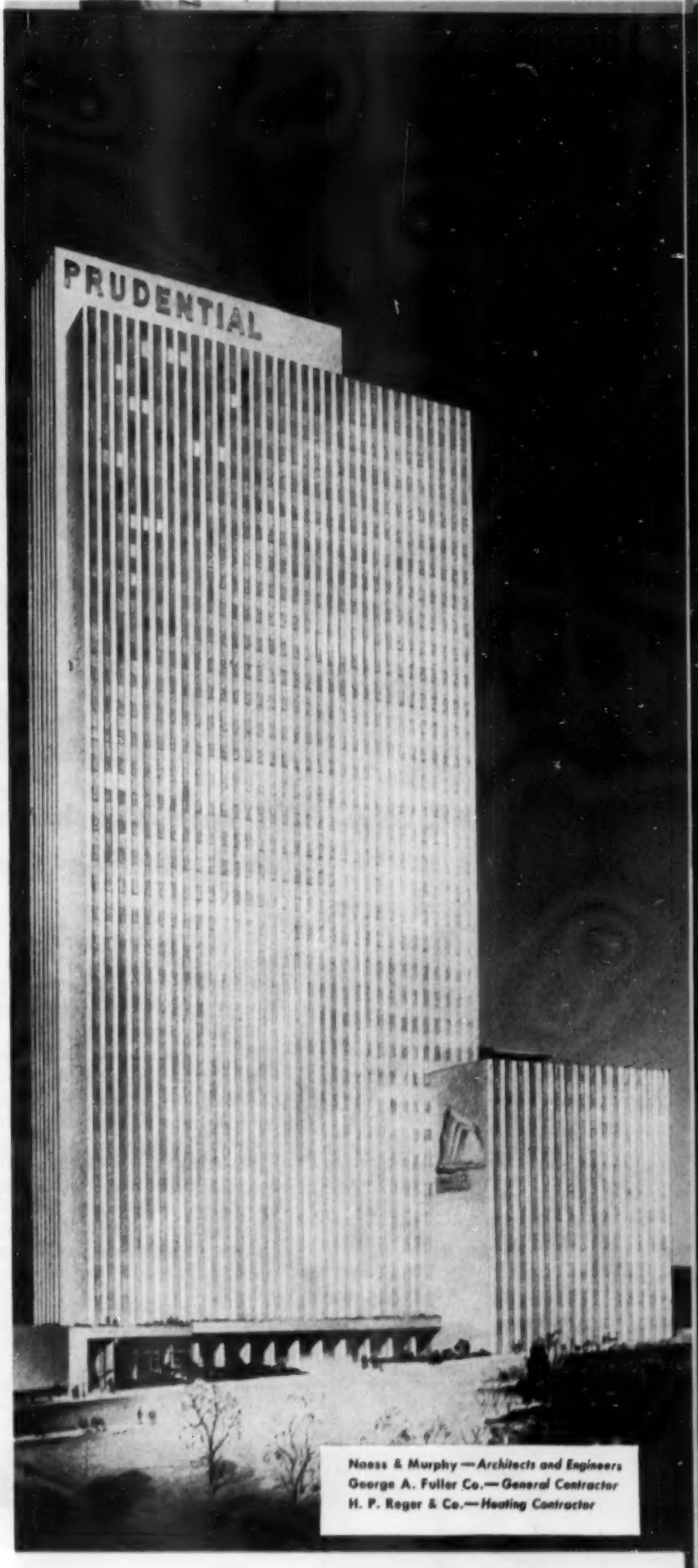
Coal is the safest fuel to store and use. No dust or smoke problems when coal is burned with modern equipment.

In most industrial areas, bituminous coal is the lowest-cost fuel available.

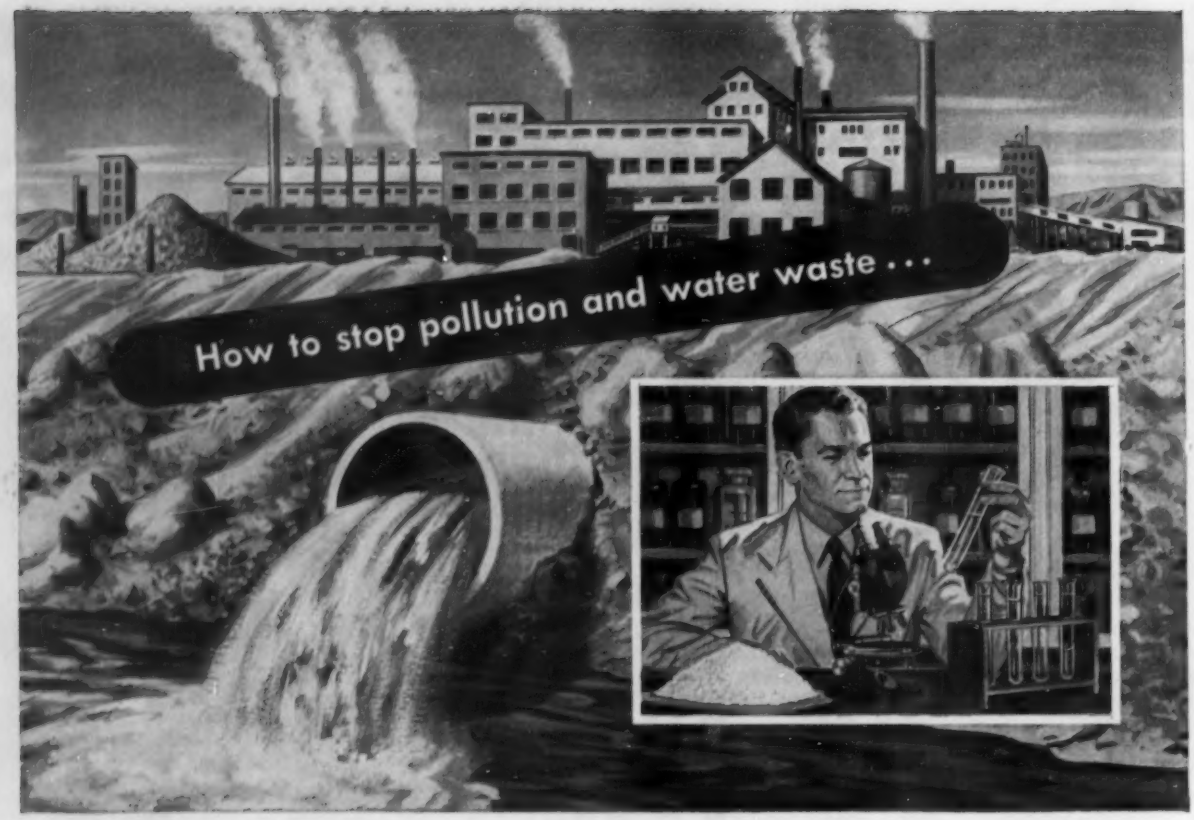
Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

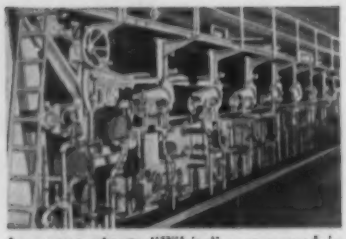
NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D.C.



Naess & Murphy—*Architects and Engineers*
George A. Fuller Co.—*General Contractor*
H. P. Reger & Co.—*Heating Contractor*



CELITE FILTRATION removes harmful impurities and purifies water for re-use



In paper plants "White" water used in paper formation is purified for re-use by Celite Filtration. The Celite method can also provide clean pure process water in many other industrial uses—for boiler make-up, heat exchangers, circulating water for towers, etc.

In oil wells—output is boosted by re-pressurizing wells with water to force out accumulated oil. Celite Filtration purifies water to the extreme degree required—removes the minute suspended impurities which would otherwise clog the microscopic pores of sandstone.

CELITE* FILTRATION can reduce your process water costs materially—and it can greatly aid your community's water conservation and anti-pollution programs.

If your plant now discharges industrial water as waste, Celite Filtration enables you to purify this water for *re-use*—at relatively low cost. Celite removes all types of suspended solids. When required, it even filters out fine matter such as amoebae and algae, many of which cannot be removed by other methods. Thus by recycling process water you can save on water costs . . . and save your community's water.

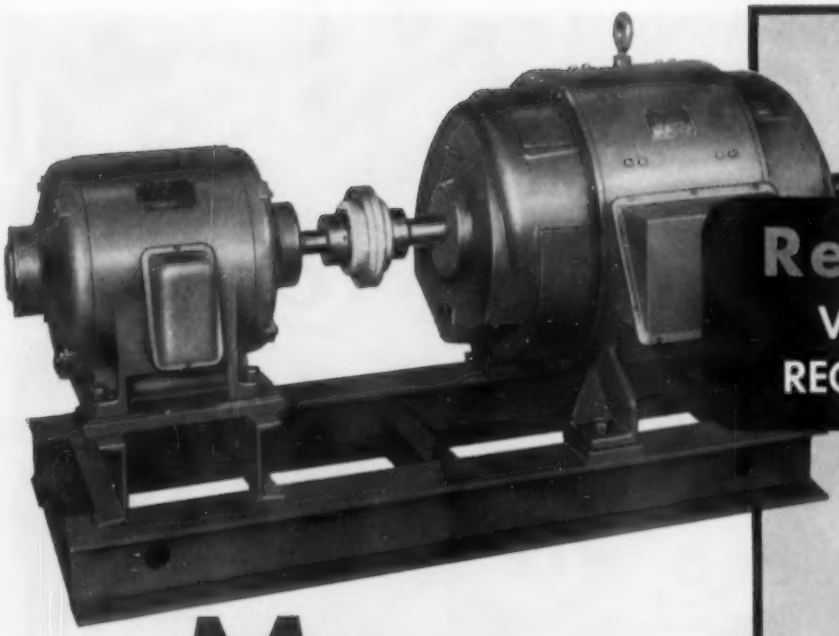
At such times as you still find it necessary to discharge process water, Celite Filtration is an important anti-polution measure. It helps make water safe and harmless . . . thereby protecting your community's recreational areas, fish and wildlife.

Food processors, beverage manufacturers, swimming pool operators and many industrial users of process water depend on Celite Filtration.

It will pay you to investigate the unique advantages of Celite for your particular application. Celite itself is carefully processed from the purest deposits of diatomaceous earth. It comes in nine standard grades, and you are always assured of utmost uniformity of product. To have a Celite engineer study your problem and offer recommendations, simply write Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto 1, Ontario. *T.M. Reg. U.S. Pat. Off.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville CELITE FILTER AIDS



Regulex
VOLTAGE REGULATORS

More Capacity

FROM YOUR PRESENT GENERATORS

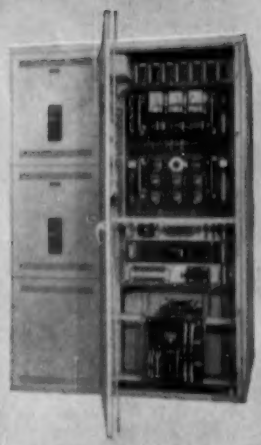
The *Regulex* voltage regulator increases generator capacity by increasing safe operating limits . . . delivering maximum productivity from existing as well as new machines.

How it Works

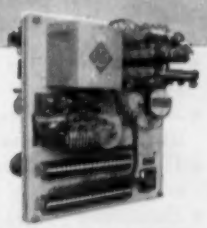
Automatic minimum excitation provided by *Regulex* control permits generator operation close to the stability limit . . . much closer than manual operation permits. Exceptional sensitivity and the rapid response of the *Regulex* regulator and associated equipment establish and maintain a safe ratio between generator load and field current. As a result, operating limits are broadened at any power factor loading . . . proper reactive kva division is assured . . . kilowatt output is increased.

In power plant application, the *Regulex* voltage regulator may be used with alternators or synchronous condensers. No multiple special fields are required in the exciter. Get all the facts. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wis.

Regulex is an Allis-Chalmers trademark.



The *Regulex* regulator consists of two parts: (1) a motor-generator set . . . (2) a cubicle containing static regulator elements.



New

Magnetic Amplifiers

These components *supplement* the *Regulex* rotating amplifier in most applications. The magnetic amplifier is used primarily where reversible output from the amplifier is not required. Special exciter design is eliminated in such applications.

A-4584

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

YOU GET BIG COMPRESSOR ADVANTAGES...

UNEQUALLED DURABILITY!

TRULY CONTINUOUS SERVICE!

...in this SMALL HEAVY DUTY JOY WG-9

The Joy WG-9 was designed to give a moderate (up to 881 CFM) but *continuous* air supply. It is suited for use both as a main air supply for smaller requirements, and as an auxiliary, or decentralized, air source in larger plants.

Heavy duty service is assured through these many "big compressor" advantages, including exclusive features not found in any other units available for comparable service:

- Water cooled for continuous operation, greatest efficiency.
- *Exclusive* . . . replaceable-on-the-job cylinder liners for easy maintenance.
- Heavy duty, ball-type main bearings which need no adjustment.
- *Exclusive* . . . field-replaceable crosshead guide of special alloy, honed to mirror finish.
- Patented "Dual Cushion" valves for efficient, lasting life and quiet action.
- Full force-feed lubrication to all working parts.
- Rugged construction throughout for long life, low maintenance.
- Single-stage, double-acting . . . vertical design for greater economy of floor space.

Joy WG-9 Heavy Duty Compressors are available in fifteen different capacities and with a wide range of pressures from 30 lbs. up. Write for bulletins on standard, booster or oil-free models, to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario*

W&D I-5504

Consult a Joy Engineer

FOR VANEAXIAL FANS • COMPRESSORS
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SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1845

This man won't be back...

The specifications read: PERMANENT GROUNDING. They used CADWELD Electrical Connections knowing that they are permanent, cannot loosen or corrode and have a greater current carrying capacity than the cable itself.

No maintenance is ever required on a CADWELD Electrical Connection.

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custom made to your mechanical and metallurgical specifications

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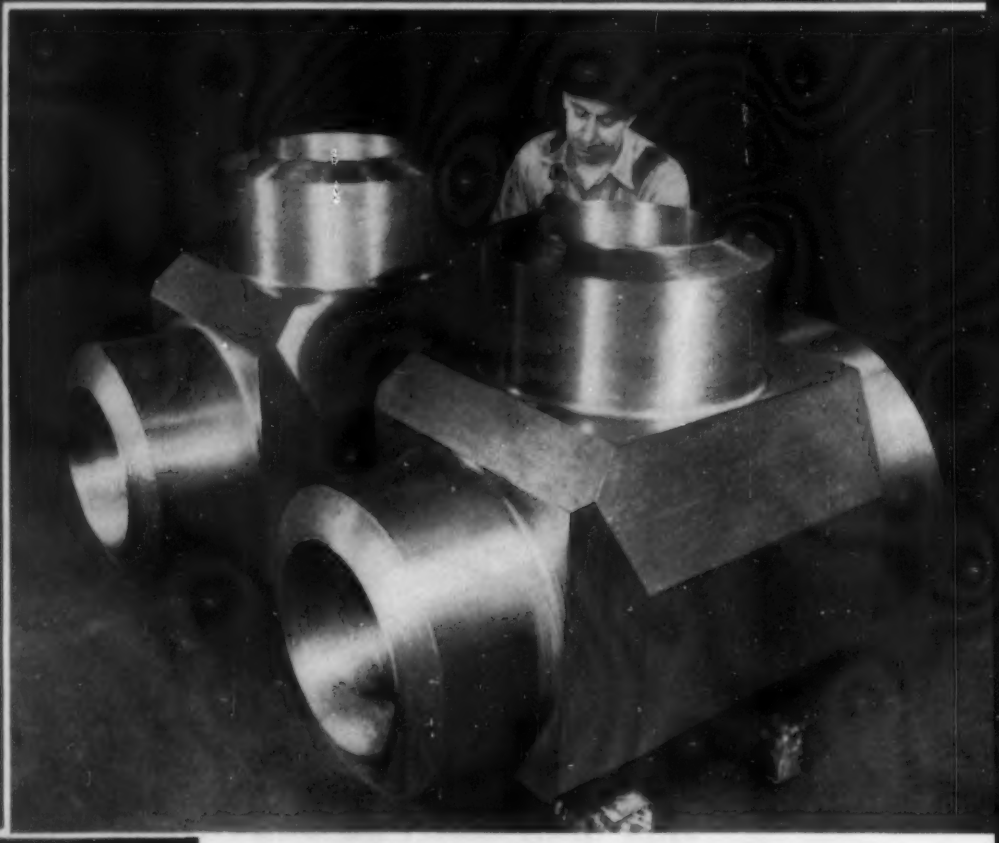

Chrome Molybdenum Alloy Steel Tees forged, machined, rigidly inspected and tested to comply with customer and code specifications. Mesta Forged Fittings and Pipe provide confident service in High Pressure and High Temperature Piping Systems.

MESTA FACILITIES *for Forged Steel Piping*

Electric Steel and Open Hearth Furnaces
Forging Presses • Heavy Duty Machine Tools
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Experienced Furnace Crews at Mesta operating the Most Modern Equipment produce the High Quality Alloy Steels required to make High Pressure—High Temperature Pipe and Fittings

ROLLING MILLS • ROLLS • FORGINGS • HEAVY DUTY TOOLS

MESTA MACHINE COMPANY

PITTSBURGH, PENNSYLVANIA

Ross Exchangers share limelight in spectacular performance of 25 Union Pacific Gas Turbine Locomotives

Pulling a heavy freight in the Wasatch Mountains of Utah, the Gas Turbine Locomotive above is one of 25 which are making history for the Union Pacific Railroad. *Each is equipped with Ross Lube Oil Coolers, Fuel Oil Heaters and Atomizing Air Coolers!*

The problems and handicaps of the Union Pacific route are known to many — rugged terrain, high altitudes, dry air, terrific winds, bitter cold, heavy blizzards and contrastingly high summer temperatures. Such a range of severe conditions demands the most rugged and dependable kind of equipment, *naturally*. The fact that Ross Exchangers are on the entire fleet of 25 locomotives speaks for itself. Again, it confirms a singular kind of confidence that has been long felt throughout industry: Ross Exchangers make other products better and, therefore, better products are equipped with Ross Exchangers.

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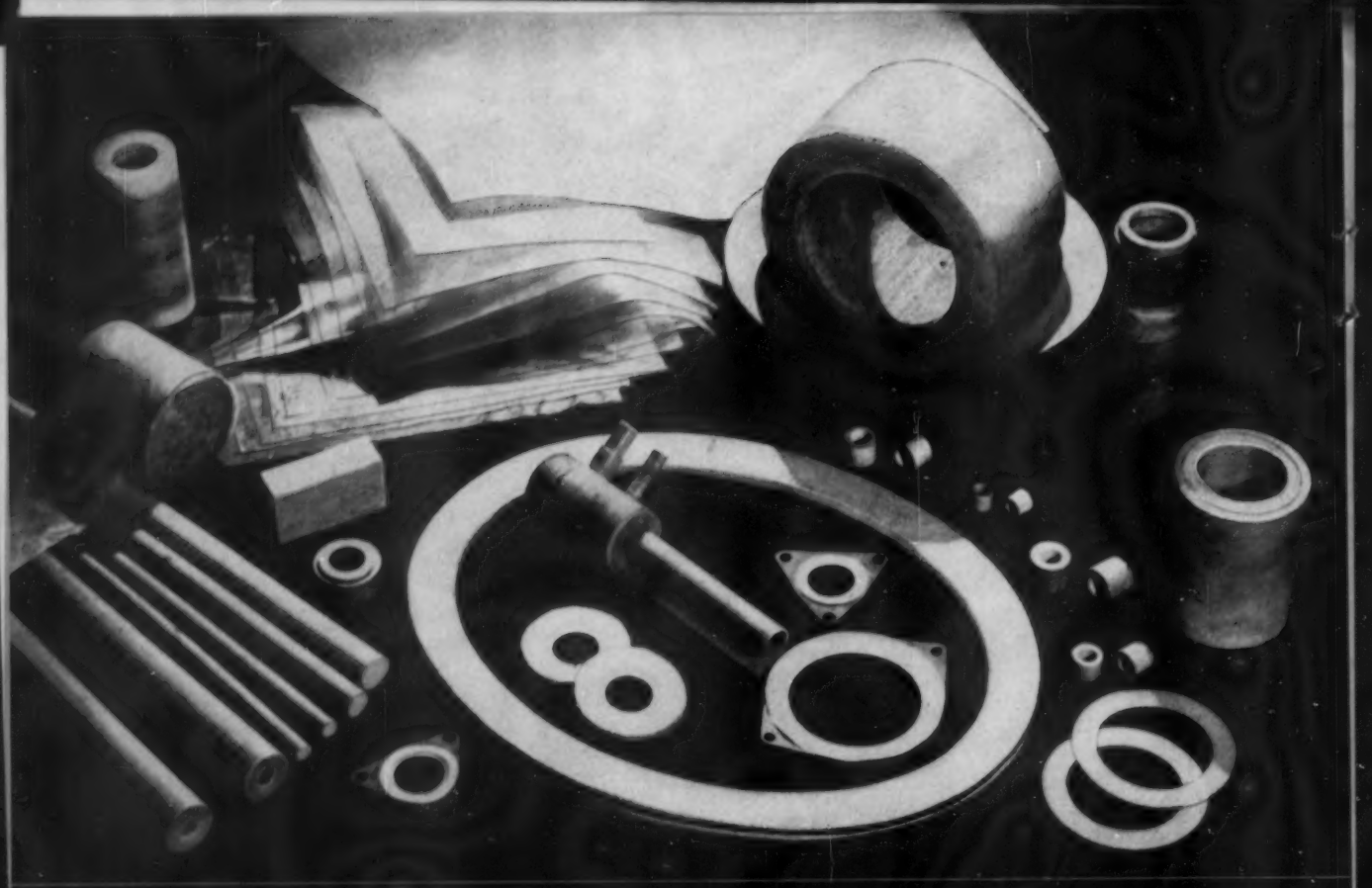
Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



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Highly Resistant to Acids . . Solvents . . Alkalies

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Where temperatures range from Minus 90°F. to 500°F. ANKLON is your answer!

ANKLON is made from du Pont's Teflon. Due to its chemical inertness and its ability to resist the destructive action of the mineral acids, organic solvents and alkalies, it is finding many uses in packing and gasket applications.

The illustration shows gaskets fabricated from sheet, machined packing rings and molded packing rings made from Teflon.

Anklon is widely used in the chemical, petroleum, refining, food, electrical, power and maritime industries.

For specfic uses, contact our Engineering Department.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.
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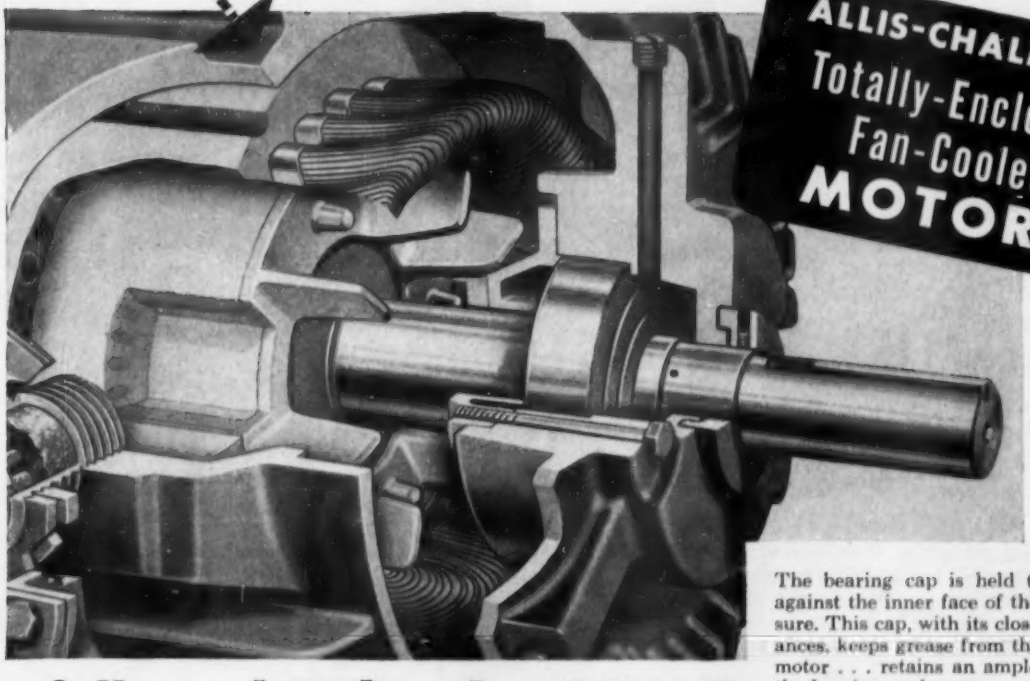
FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

Get Both
bearing features



ALLIS-CHALMERS
Totally-Enclosed Fan-Cooled MOTORS

fully enclosed and protected

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

. . . yet easy to grease

You can lubricate the bearings without dismantling the motor. Pipe-tapped holes in the bearing housings at three points provide both means for inserting new grease and a means of flushing out old grease.

Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7225.

A-4609

ALLIS-CHALMERS

DEAERATING EFFICIENCY

less than seven parts per billion guaranteed!

These are words. What you want is *PERFORMANCE.* Cochrane's unparalleled experience in years and number of installations with all types of deaerating equipment assures you that *guarantees will be met!* Check this statement with any Cochrane user.

Cochrane has the greatest number of deaerating heater installations of any manufacturer in the world. Manufacturing every type of deaerating heater and water conditioning equipment, Cochrane's *complete* service assures you unbiased recommendations for equipment to performance specifications. It assures undivided responsibility for engineering, fabrication and satisfactory continuing operation by a single company.

For further information on Cochrane Deaerators, write for Publication Nos. 3005, 4643 and 4635.

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Cochrane ion exchange units deliver a continuous supply of demineralized silica-free water at extremely low cost. Pub. No. 5800.

HOT ZEOLITE

Replaces second stage phosphate treatment in hot-process softener. High temperature ion exchange resins completely remove residual hardness at great savings in soda ash and phosphate. Pub. No. 4801.

SOLIDS CONTACT REACTOR

Slurry blanket principle efficiently removes solids, turbidity, color, taste, silica, fluorides, and reduces alkalinity from water for industrial and municipal purposes. Pub. No. 5001-A.

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Deaerators • Heater Storage • Condensate Return Systems • Hot Process Softeners • Hot Zeolite Softeners • Dealkalizers • Demineralizers • Reactors • Continuous Blow-Off • C-B Systems • Specialties

Spotting the 'Comers'

DID YOU EVER STUDY the reactions you get when you pitch a sticky plant problem at a group of your assistants? Chances are you've been so interested in getting the right answer that you haven't. Try it next time—I'll bet you get some quick comebacks like these typical quotes:

"The whole trouble is in the production departments, the foremen just don't cooperate. . . ."

"Now if this was an electrical problem, I know what I'd do, but since it isn't. . . ."

"If we had a different piping layout, we wouldn't run into situations like this. . . ."

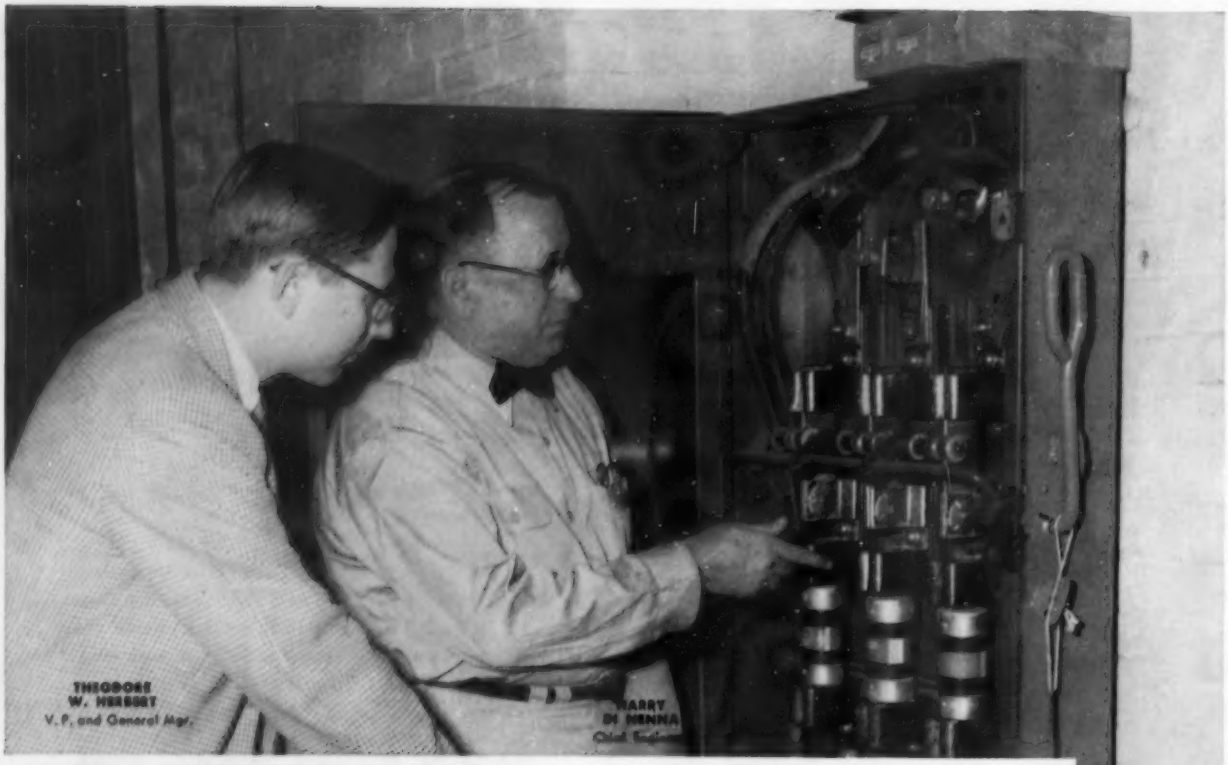
After a little more of this fault finding, buck passing, and wishful thinking, you'll feel mighty good when somebody takes hold and starts digging for answers. Make a mental note right then to keep an eye on that lad—whether he comes up with the final solution or not. He shows what the psychologists call a *problem-solving* response. And that, they say, is a trait of most successful executives.

Why do the experts put the emphasis on this business of *response?* Because, to put it bluntly, no one can solve a problem until he comes to grips with it. And too many people fail at just that point. They dodge the issue, try to blame somebody else, take refuge in a problem-free dream world.

If we look even deeper, we see that an instinctive facing up to a situation is a reflection of a responsible attitude. The responsible man refuses to indulge in the all-too-human tendency to seek an easy way out. He says, in effect: "So we're in a spot. Let's not waste time now arguing about whose fault it is, worrying about how it could have been avoided, or thinking how nice it would be if our difficulties just went away quietly. As a responsible member of this organization, it's up to me to help do something constructive. Let's define exactly what the problem is, line up some facts instead of arguments, start batting out some ideas."

That's the first step toward a solution. When a man reacts that way, he puts himself—and the rest of his group—on the right track. In such an atmosphere, some one is sure to come up with a good answer. No matter who it may be, chalk up a credit for the lad who started the ball rolling.

This is one way to spot the "comers." Certainly there's a great deal more to being a successful manager than displaying problem-solving behavior. But it's a clue, and a good one. Use it in your constant search for the men who will run your plant operations in the years to come. And it won't hurt any of us to measure ourselves against this yardstick. Are we—you and I—as mature and responsible as we should be? Do we respond constructively?



"We can now push our equipment 24 hours a day without fuse blows causing needless shutdowns, thanks to Fusetron *dual-element* Fuses."

"When we are on a tight schedule, we must operate 24 hours a day to fill our orders. Every piece of equipment in the plant is pushed to its limit. A work stoppage of any kind is more than annoying, it is most important as we just can't afford to waste time.

"We were using ordinary fuses to protect our motors, but these fuses couldn't hold up under the pressure. They would blow often and as I now know — needlessly.

"Every time a fuse blew we were losing money. I would start figuring how much harder and faster we would have to work to get back on schedule.

"Something had to be done. We called upon Mr. Paul Serotta of the Norristown Electric Supply Company. He recommended we discard our old fuses and replace them with Fusetron dual-element fuses.

"That was the answer all right. We can really notice the difference. Now, when we are on full production basis I am not worried that our equipment will be out of operation by the needless blowing of fuses."

Harry DiNenna
CHIEF ENGINEER
HERBERT HOSIERY COMPANY
NORRISTOWN, PA.

Play Safe! install Fusetron and BUSS Hi-Cap

Fusetron Fuses Do More Than Eliminate Shutdowns Caused By Needless Blows . . .

FUSETRON FUSES PROVIDE 10 POINT PROTECTION . . .

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnouts.

FUSETRON FUSES SAVE YOU Maintenance and Recalibration Costs

Once properly installed, Fusetron fuses require no costly inspection time or maintenance necessary on mechanically operated devices.

Dust, fumes, corrosion or age cannot prevent a Fusetron fuse from opening safely. There are no hinges, pivots or contacts to stick or slow down the operation of the fuse on short-circuit.

When a Fusetron fuse does open to protect, and after the fault has been corrected — the new Fusetron fuse you have installed has been *calibrated at the factory by engineers* — it is a fuse as safe and dependable as the one that blew.

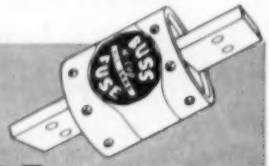
FUSETRON FUSES GIVE YOU GREATER SAFETY, BECAUSE OF THEIR HIGH INTERRUPTING CAPACITY

Tests verified by the Electrical Testing Laboratories of New York indicate that Fusetron fuses can interrupt safely the most severe available short-circuit current.

The tests circuits were set to deliver in excess of 100,000 amps. In each test the fuse cleared the circuit safely, the fuse remained intact, there was very little noise and cotton packed around the fuse was not ignited.

Yet there has been no interference with the time-lag characteristic of Fusetron fuses.

FOR LOADS ABOVE 600 AND UP TO 5,000 AMPS., BUSS Hi-Cap FUSES PROVIDE . . .



Unlimited interrupting capacity to handle any fault current regardless of system growth! This was confirmed by tests witnessed and reported upon by the Electrical Testing Laboratories of New York.

Overload protection as well as short-circuit protection.

Coordination with Fusetron fuses on feeder and branch circuits to limit fault outages to circuit of origin.

On old installations, a safe and relatively inexpensive way to protect inadequate circuit breakers against rupture in event of bad fault.

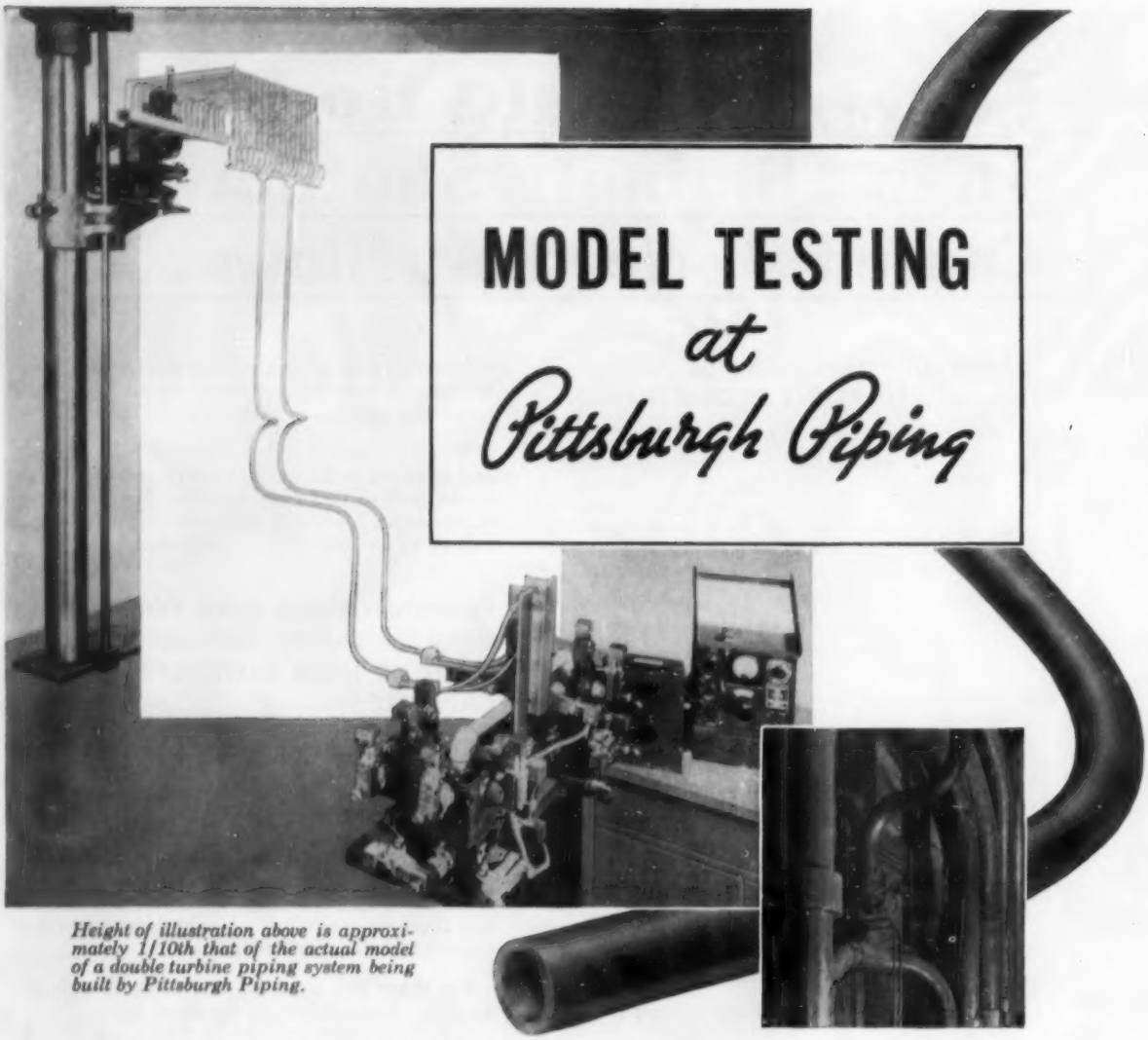
Dependable service through the years because there are no moving parts to stick or get out of order.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Blowing time charts and more information are available on FUSETRON Fuses and BUSS Hi-Cap fuses. Write for bulletin FIS and HCS.

BUSSMANN MFG. CO., (Division of McGraw Electric Company) University at Jefferson, St. Louis 7, Mo.

Fuses throughout the entire Electrical System!



MODEL TESTING *at* Pittsburgh Piping

Height of illustration above is approximately 1/10th that of the actual model of a double turbine piping system being built by Pittsburgh Piping.

Accurately Predicts Physical Reactions of HIGH PRESSURE, HIGH TEMPERATURE PIPING

Model testing makes practical the planning of high pressure, high temperature piping systems with advance knowledge of end reactions, stresses, and deflections encountered in actual operation.

The model illustrated exactly duplicates from an engineering standpoint — in miniature — a double turbine piping installation being built by P.P.& E. for one of America's foremost utilities. Highly specialized testing apparatus accurately measures and directly indicates physical reactions at all points of this model under simulated operating temperature and pressure loads. These measurements are projected to give precise information on the full size system.

On complex piping layouts model testing at Pittsburgh Piping is the only practical means to obtain a complete analysis. It eliminates the need for dependence on theoretical approximations, and minimizes the possibility of mathematical error. Data obtained from model testing enables construction of a full size system which is free from excessive stresses, reactions and movements which could damage joints, anchors and equipment connected to the pipe line.

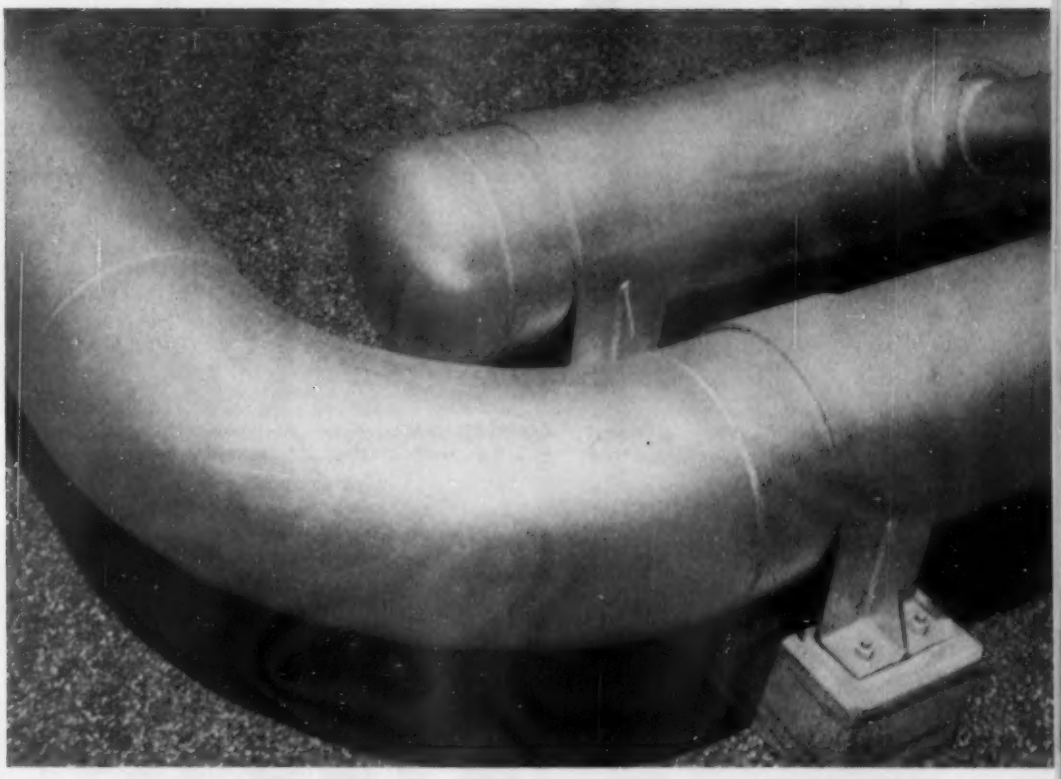
Promoting Progress IN POWER AND PROCESS PIPING . . .

Atlanta	Whitehead Building	Houston	Heights State Bank Bldg.
Boston	10 High Street	Los Angeles	1830 N. Alexandria Ave.
Chicago	Peoples Gas Building	New Orleans	P. O. Box 74
Cleveland	Public Square Building	New York	Woolworth Building

Pittsburgh Piping AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna. PP-8

Power
APRIL 1955



Space-saving piping affords one example of . . .

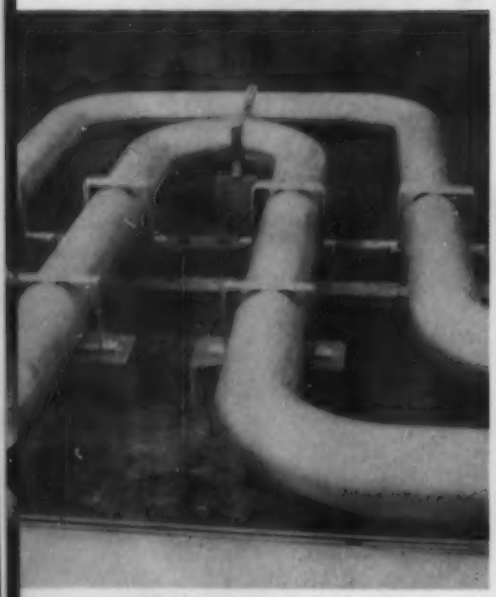
How to reduce piping cost with welding fittings and flanges

- Welding fittings provide the most economical and efficient means of joining pipe for many kinds of industrial jobs
- Permanently leakproof, the piping needs little or no maintenance, is easily insulated, and can be tailored to a limited space or to the physical contours of buildings, terrain or equipment
- Systems using welding fittings and flanges are lightweight, give easy flow transition, reduce fluid pressure loss
- Less flow turbulence reduces erosion, increases piping life

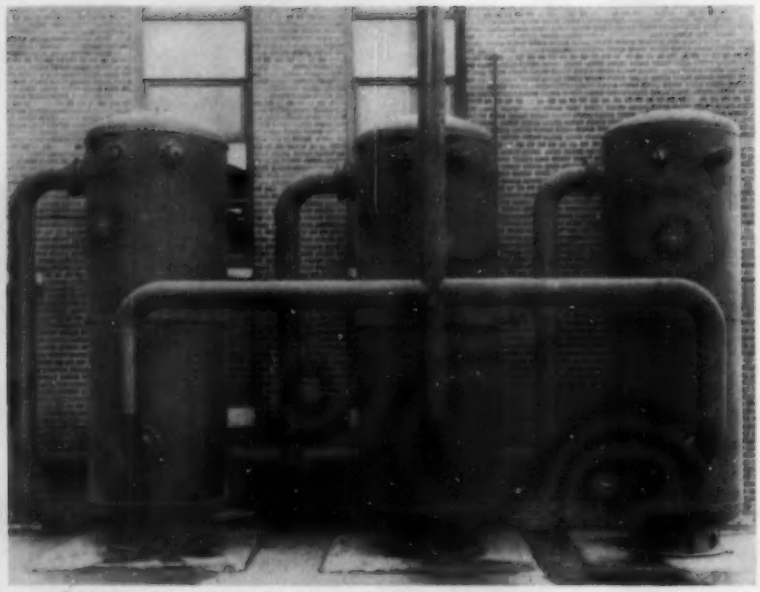
Turn page

By JACK TOLLIVER
Tube Turns, a division of National Cylinder Gas Co

PIPING COST continued



EXPANSION LOOPS, single or nested. Easily fabricated from welding fittings



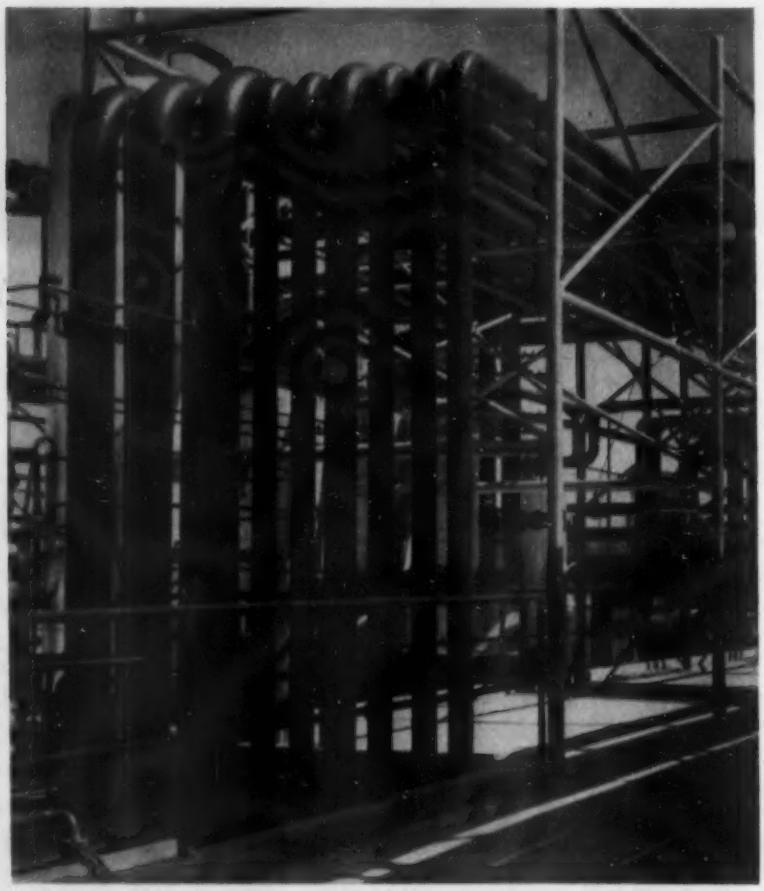
COMPRESSED-AIR receivers neatly and efficiently piped for 100-psi air pressure with 8-in. welding fittings. Note how symmetrical layout eases system operation

Piping for gas and vapors

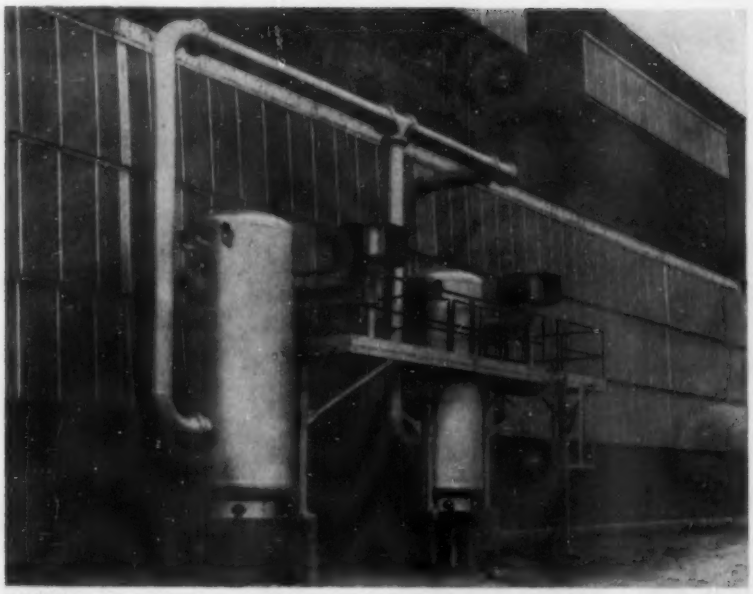
Piping for conveying gases and vapors is a major item in many industries. The illustrations on these two pages show but a few of the hookups possible when using welding fittings and flanges.

Careful study of these pictures will reveal many valuable design hints for piping in such service. They also show how ingenious use of welding fittings and flanges saves on piping costs.

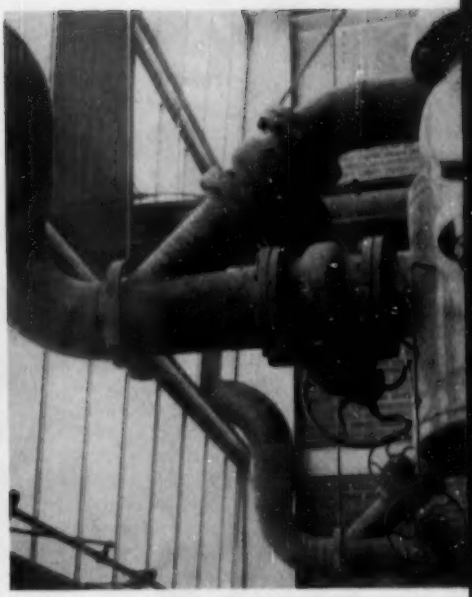
For best results in design and construction of gas and vapor piping systems the *Code for Pressure Piping,* ASA B31.1, or local regulations, should be followed. Sections 2 and 3 of the *Code* cover a wide variety of industrial installations for air, gases, oil vapors, refinery gas and others.



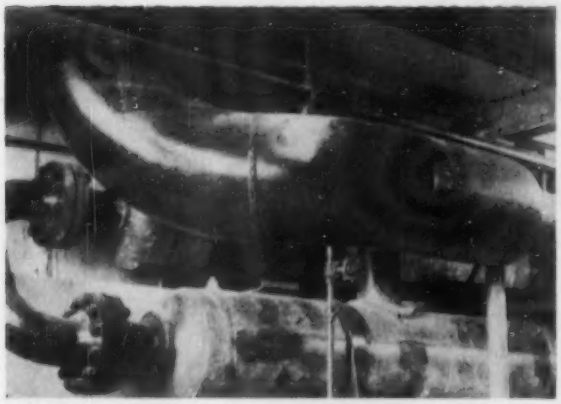
NESTED PIPING made up with welding fittings and flanges takes less space than with other types of connections. These gas lines serve a thermal cracking unit



ANOTHER compressed-air receiver installation using welding fittings and flanges. These 100-psi receivers have 8- and 10-in. carbon-steel (cs) fittings. Note filters

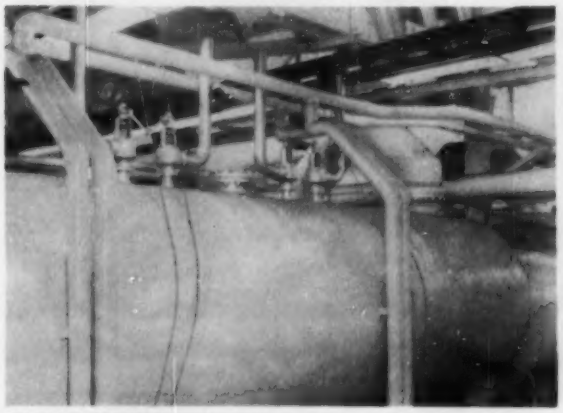


INTERIOR view of installation at left. The lines here are cs: 8, 10 and 12 in.

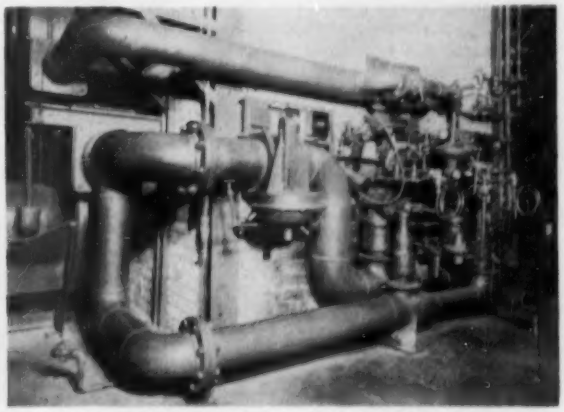


GAS-INLET LINE to internal-combustion engine is increased from 12 to 20 in. by eccentric reducer, 45- and 90-deg ells

UNDERGROUND header fabricated from welding fittings saves space, reduces cost and gives longer life with less upkeep



COMPRESSED-AIR receiver in penicillin plant is served by 2- and 4-in. piping and welding fittings. Note safety valves



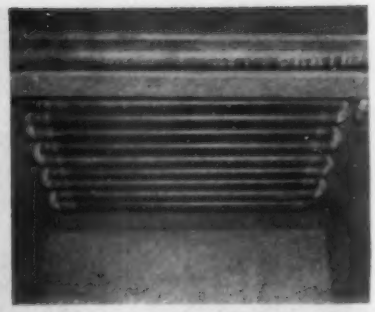
GAS, COMBUSTION-AIR and oil lines for burner installation fabricated from ½- to 10-in. carbon-steel welding fittings

Steam and condensate

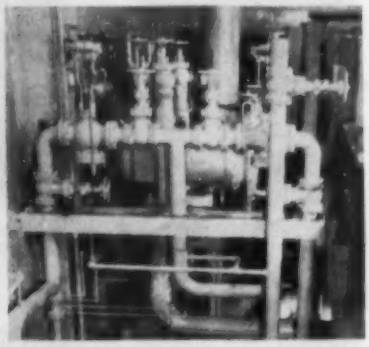
Welding fittings and flanges are ideal for steam and condensate piping because insulation is so easy to apply once the piping is erected. The welded joint becomes part of the pipe itself. Many of the illustrations at the right were taken before insulation was applied so piping details could be seen.

As with gas and vapor piping, the *Code* is the best guide to safe practices in design and construction of steam piping for industrial plants.

"SNEAKING" line through a wall is easy with two welding fittings, as shown here



HEATING COIL made with 1½-in. 180-deg returns heats steel blanks for forges

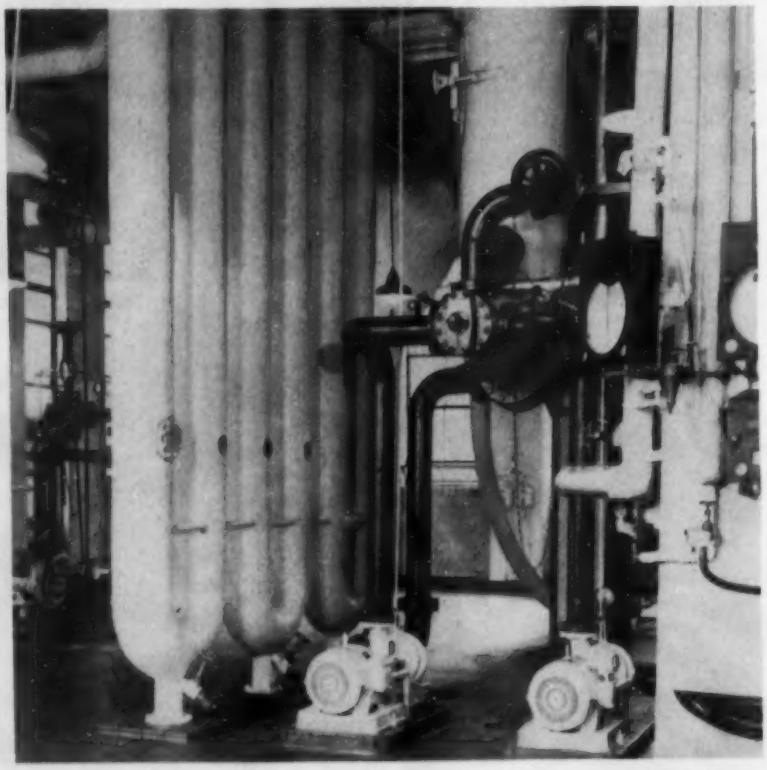


WELDING fittings and flanges in central station make neat, compact installation

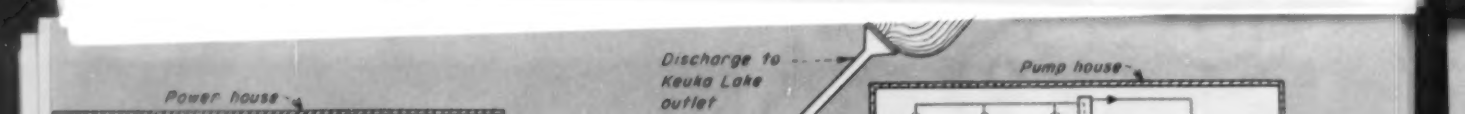
Liquids and process fluids

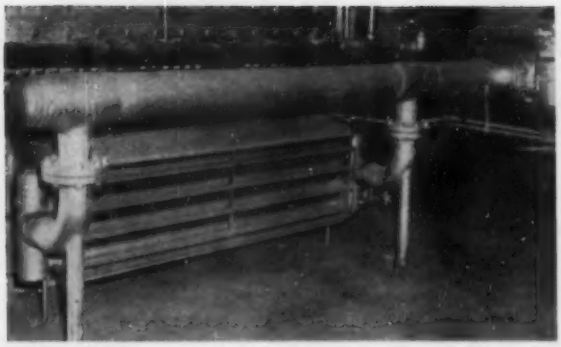
Though hot and cold water are perhaps the most common liquids piped for industry, many others run a close second. Where corrosive liquids must be handled, welding fittings and flanges of various alloys are available. These, as with fittings made of other materials, can be erected in shop or field to reduce costs.

Today many new materials are available for welding fittings—including chrome and nickel steels, commercially pure alloying elements—nickel, copper, aluminum and others.

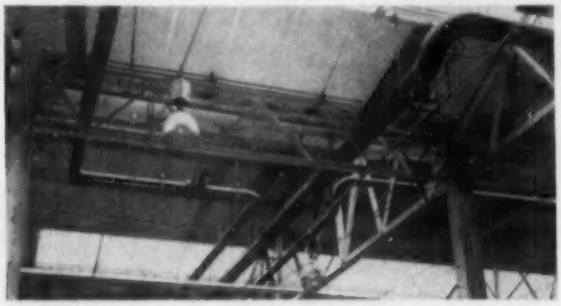


U-TUBE MASH COOKER fabricated from welding fittings and flanges. This is another example of how welding fittings can be used to make up special process equipment

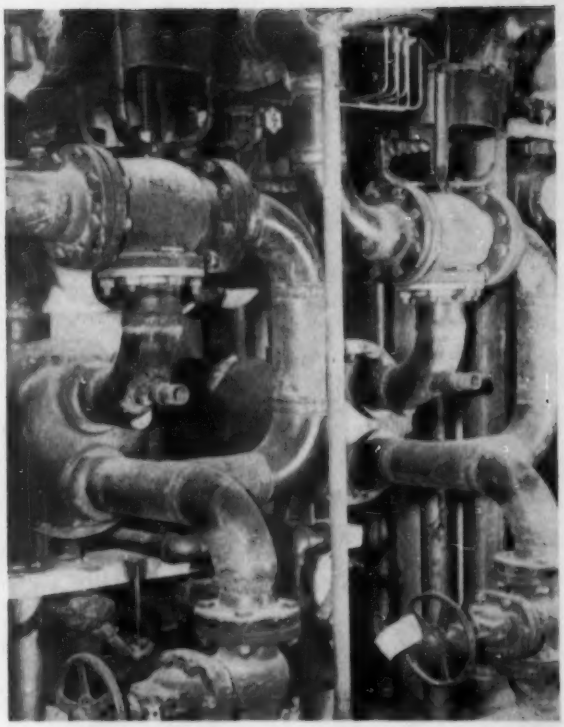




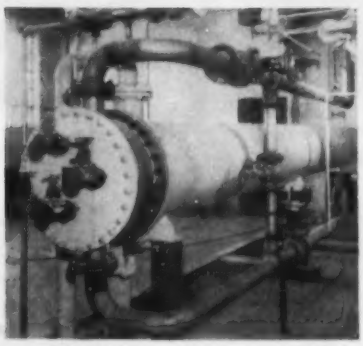
HEADER fabricated from welding fittings and flanges serves steam curing plant. Note how the supports are welded to ells



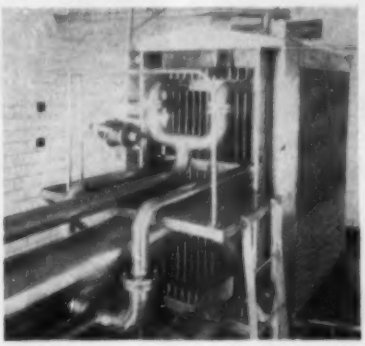
OVERHEAD 12-in. 150-psi steam line, 6-in. return and 8-in. compressed-air line (all carbon steel) before insulation



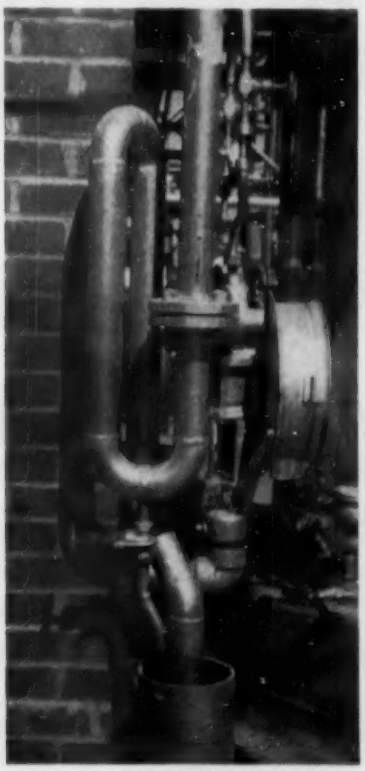
HOT-WATER CONVERTER steam-supply and return lines before being insulated. Note the number of fittings in small space



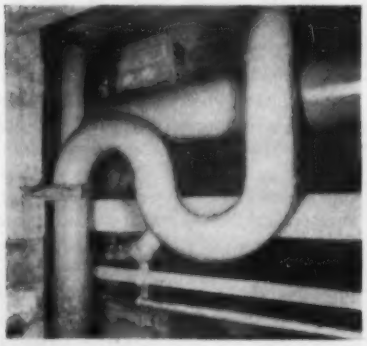
STAINLESS-STEEL welding fittings on a process heat exchanger reduce corrosion



BREWERY uses stainless-steel welding fittings to avoid product contamination

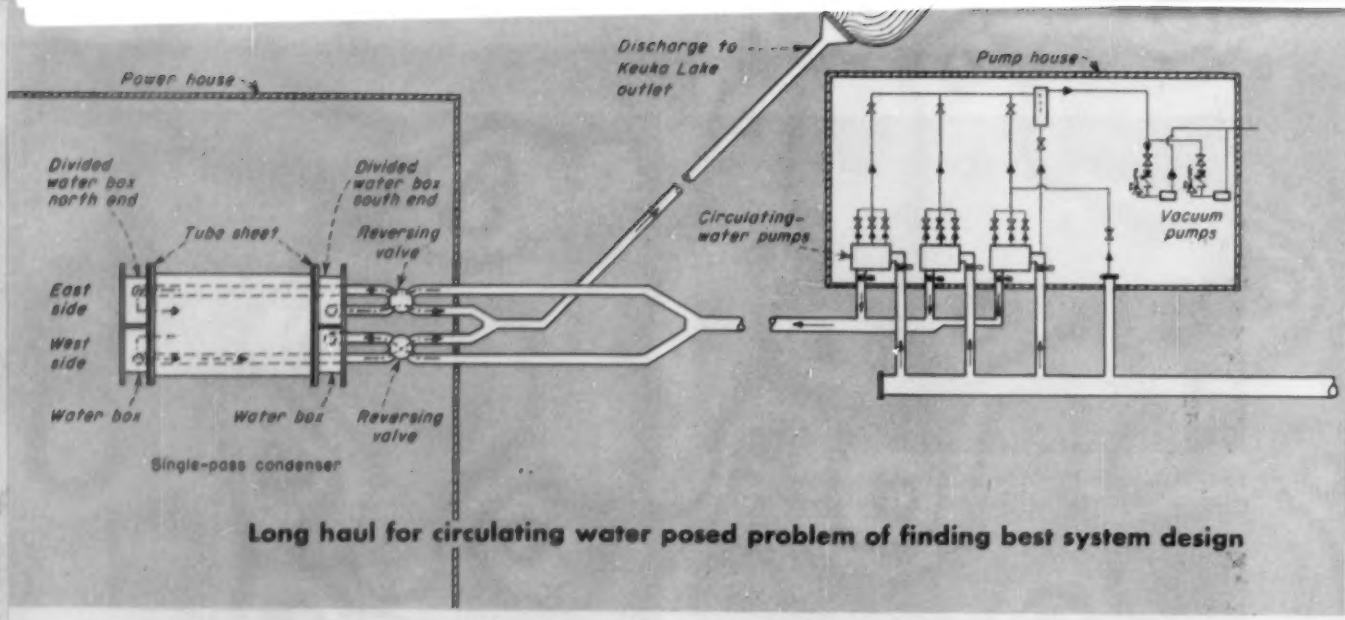


WATER drain trap serves hydroformer; made up of standard welding pipe fittings



TRAP in power-plant floor drain is made up of welding fittings. Note the cleanout

NESTED 4-in. oil lines in oil-canning plant use welding fittings to save space



Long haul for circulating water posed problem of finding best system design

INTAKE CRIB marks start of 1872-ft circulating water line. Bitumastic and bituplastic coat the water line against weather

CIRCULATING-WATER LINE runs up to pump house, *at left*. One of three 36-in. pump intakes taps the 7-ft-dia main line

Screenless water intake proves troublefree

Year's operation of unique circulating-water system meets expectations at Greenidge Station of New York State Electric & Gas Corp. Condenser-tube sheet acts as water screen

By W Greacen, *Chief Mechanical Engineer, New York State Electric and Gas Corporation*

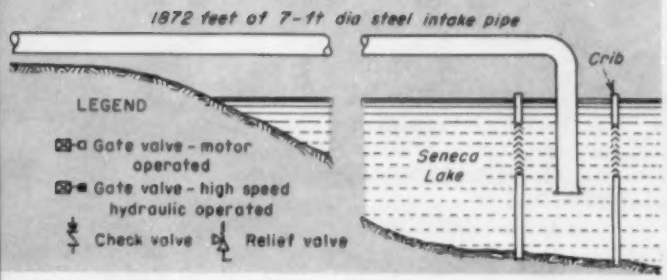
► Greenidge Station's 100-mw Unit 4 has an unusual circulating-water system. It has no traveling water screens and a siphon system brings the water some 1872 feet from Seneca Lake to the pump house.

The unit has run for a year with the condenser tube sheet acting as a water screen. With automatic reversing valves acting to flush off the debris this has worked most satisfactorily. The siphon system has worked without trouble, but some modifications to auxiliaries were needed.

Why no screens? Greenidge Station is in central New York State on Seneca Lake, largest of the five picturesque Finger Lakes. The clear, cold water has little debris except seasonal grasses and leaf mats.

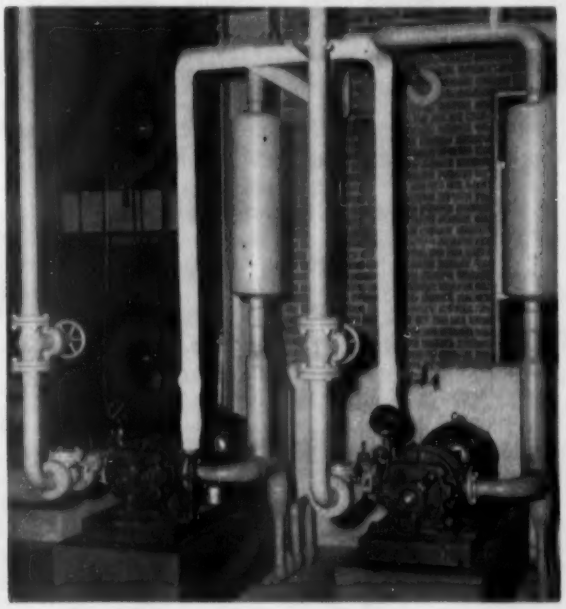
We had considered vertical circulating pumps with conventional screen house and traveling water screens. These

BAFFLED CRIB INLETS keep floating trash out of siphon intake. Overhead circulating-water line lessens maintenance cost. Keeping pump house close to main plant requires fewer operators



MOTOR-OPERATED REVERSING VALVES are automatically shifted to back flush condenser when the tube sheet clogs up

PUMP HOUSE has mezzanine floor above three pumps and their motor drives. Motor-operated valves line up at wall



VACUUM PUMPS take about five to six hours to remove air from 1872-ft pipeline and prime pumps when first starting up

pumps need proper inlet flow conditions or expected performance won't be realized. Drawings prepared by our consultants, Gilbert Associates, Inc, were reviewed with condenser and pump manufacturers. These included a costly approach structure, screen house and pump bay to insure best performance.

Some compromise had to be reached or our preliminary estimates for the water system would be topped by more than $150,000. The first thought was, "Why not horizontal pumps? Some slight loss in efficiency, but no particular inlet flow problems; hence a simplified structure." It wasn't that easy.

A screen house for horizontal pumps and screens was smaller in width but the length would make it cost $20,000 more than for vertical pumps. This, coupled with a probable 3% lower pump efficiency, wasn't attractive.

One big cost factor, for either scheme, was the depth of screen-house forebay structure and pump pit. If the screens could be eliminated a large cut in size and cost of the structure could be made. Our engineers made this suggestion and after a thorough review, we agreed it was a good compromise.

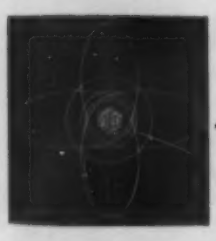
Final plan. Pictures, above, show the layout of the system. Three half-capacity, horizontal circulating pumps, 30,400 gpm each, connect directly into individual branches from the 84-in.-diameter siphon intake. The third pump insures continuity of water supply if one pump has to be opened for cleaning during eelgrass season. So far, this hasn't been needed. If future operation continues to be troublefree, this third pump will become part of any future extension of the station. Gate valves on both suction and discharge avoid the hanging up of grasses that would occur on the leading edges of the disks of butterfly valves. Pump impellers are of special design without sharp edges to minimize fouling.

Interesting problems were how to minimize the debris entering the water system and how to eliminate the need for periodic cleaning of grids or bars surrounding the intake. A review of close to a dozen designs showed us that the crib-type structure was the most practical.

Sheet piling, driven into the lake bottom, forms a square 27 feet on the side. The piling is cut off 9 feet below lake level. Steel columns, driven in at the corners and the center point of each side, extend above the water line. They support chevron-baffled openings, which reach from the top of the sheet piling to 1½ feet below water level on each side of the square.

The siphon-line invert enters the water

(*Continued on page* 228)



Nuclear notes

By B G A SKROTZKI, *Associate Editor*

Britain plans ambitious nuclear-fired central-station program: 1500-2000 mw by 1956; 3000 mw by 1970; 10,000-15,000 mw by 1975. They hope to produce a kwhr for 7 mills from first unit with lower costs from succeeding units. Britain's total generating capacity of 20,000 mw is expected to grow to about 55,000-60,000 mw by 1975. This figures up to a coal shortage of 20 million tons a year, hence strong need for atomic plants. First prototype plant, at Calder Hall, will cost some $50 million and generate about 50 mw.

Operating temperature of aluminum-encased fuel elements will run 660-840 F. Graphite-moderated reactors will use either helium, CO_2 or other gas coolant and produce plutonium as well as heat. Planners hope to get 3000 mw-day of energy from each ton of uranium-enriched fuel elements.

Potato starch may help to recover low-grade uranium from phosphate wastes, according to *Columbia Research News*. Millions of tons of waste slime, from phosphate rock processing, held in artificial lakes in Florida will be a new uranium source. The starch helps to filter out colloidal particles holding uranium.

Interesting conclusions reached by a *Conference on Nuclear Physics in Engineering Education* at Columbia University say: (1) majority of engineers in nucleonics field do not need detailed knowledge of the science, but must have qualitative knowledge (2) specialization in nuclear engineering not warranted at undergraduate level (3) must qualities for nuclear engineer are ability for analytical and creative thinking because of rapidly advancing technology.

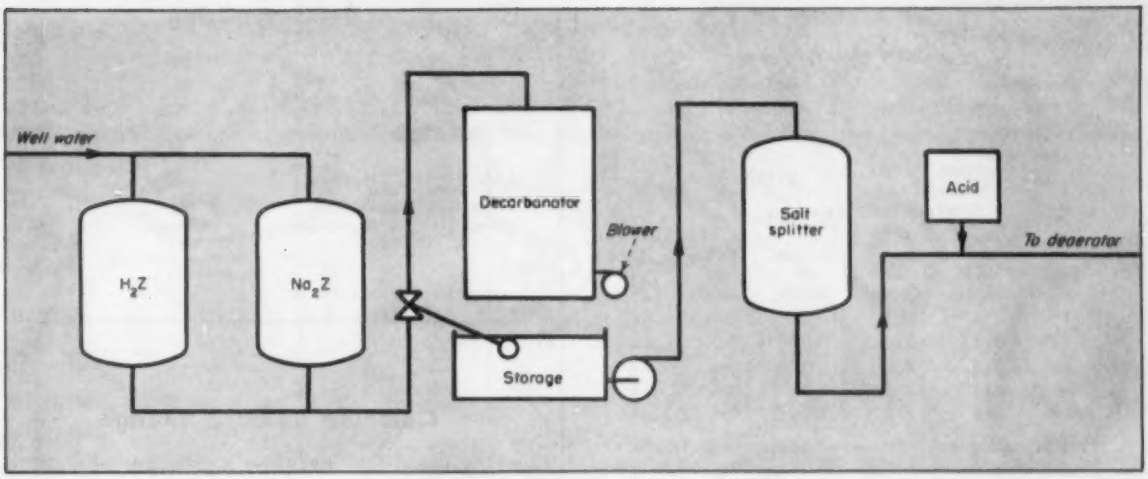
AEC and ASME will share cost of $25,000 project to develop data on high-temperature piping. AEC's Knolls Lab, run by GE, will make investigations. ASME will contribute $10,000 and group of technical experts for cost-free consultation.

Atomic explosion effects on electric transmission and distribution lines, substations, and other apparatus will be researched in April at Nevada test site. Edison Electric Institute has engaged Bechtel Corporation to supervise construction of electrical structures for the test.

Sound engineering, not secrets of nuclear physics, is the missing link in making fission energy useful, says W L Cisler, president of Fund for Peaceful Atomic Development. Pointing up this philosophy, L R Hafstad adds: How to build leak-proof pumps for circulating radioactive coolants, how to make repair-proof pipelines, how to build foolproof remotely-controlled mechanical hands for stoking atomic furnaces are sample problems delaying the Atomic Age.

Traveling for Fund, Dr Hafstad will visit India, Turkey, Italy, Switzerland, France, Belgium and Great Britain. He will endeavor to set up worldwide network to exchange atomic information and speed development of technology for all.

Sourdoughs go scientific by using scintillometer for finding gold, says M M Reiss, president of The Radiac Co. Traces of uranium ore often associated with gold and silver deposits send out gamma rays that can be detected by a scintillometer. The 5-lb instrument can point out deposits buried hundreds of feet deep. These radiations can be detected even from an airplane.



SILICA IS REMOVED in this setup by salt splitter. Hydrogen zeolite reduces alkalinity, acid converts hydroxide to sulfate

New way to remove feedwater silica

Studies for 650-psig boiler plant covered demineralization and hot-lime zeolite. Then salt splitting was tried to cut initial cost*

By S B APPLEBAUM, *Manager*
Water Treatment Div, Cochrane Corp
and B W DICKERSON
Engineering Dept, Hercules Powder Co

► ABOVE 500 PSIG, silica in boiler water often forms hard boiler scale and, more important, causes glassy deposits in the turbines. These glassy deposits reduce turbine efficiency sharply and make costly outages necessary.

Basically, turbine silica deposits are held down by keeping silica in turbine steam low. This, in turn, calls for low concentrations of silica in the boiler water (silica in steam is a function of silica in boiler water). Boiler blowdown is one means of getting these low concentrations. But with high silica content in the makeup feedwater, blowdown becomes excessive. Feedwater treatment then becomes necessary.

Silica removal by demineralization and by hot-lime zeolite treatment gained general acceptance during the last few years. We will discuss a possible third method here—salt splitting. All three methods were considered for the Hercules Powder Company's plant at Brunswick, Georgia. And since extensive research was carried out for all three, a good comparison is possible.

Future plans for expansion at the Brunswick plant call for a total steam load of 420,000 lb per hr. The makeup needs would be about 300,000 lb per hr, or 600 gpm. So water-treatment plant must handle 600 gpm—and there is an added requirement for easy expansion to 800 gpm.

The boilers have an operating pressure of 650 psig. Backpressure turbines exhaust at 125 psig. Boiler-water silica content of 50 ppm has proved satisfactory in preventing turbine silica deposits in these units. Since the raw water contains 30 to 40 ppm silica, its removal is a must.

Preliminary studies. First methods considered for this plant were demineralization and hot-lime zeolite treatment. Table, p 85, gives analysis of raw well water and expected analysis of treated water by these two methods. Main chemical costs (excluding phosphate, sulfite, etc) and unerected equipment cost are also given.

Demineralizers were ruled out because of higher operating and first costs, as these 650-psig boilers could be operated with boiler-water concentrations as high as: 2000 ppm total solids; 250-ppm alkalinity as $CaCO_3$; 50-ppm silica as SiO_2.

Boiler blowdown with the hot-lime zeolite method would be less than 10% of the makeup (see table, p 85). So preliminary decision favored this method.

But an engineering estimate showed that the total investment for the hot-lime zeolite method would be over $300,000. This included cost of erection, chemical-storage building cost, railroad siding, chemical-handling equipment and plant piping costs. A search for another silica-removal method that would reduce initial investment was indicated. So the next study dealt with the third possible method—salt splitting.

Salt splitting. The same strongly basic anion-exchange resins used in demineralizing following hydrogen cation exchangers are also used in salt splitting. In other words, they not only can adsorb strong and weak acids, but they can also split salts (exchange anions for chloride or hydroxyl in the resin).

Table of equations, top right, p 84, shows the various anion-exchange reactions. Anion-exchange resins regenerated with sodium chloride reduce alkalinity by converting it to chlorides. The second equation gives this reaction—but it does not reduce silica. Caustic-soda regenerated resin does reduce silica,

*Adapted from paper presented before the sixteenth annual meeting of the American Power Conference.

Typical exchanger run

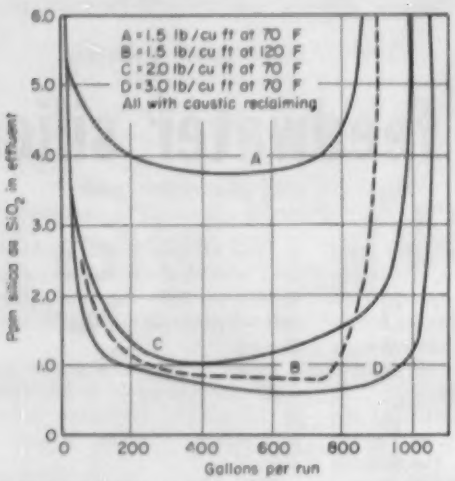
INFLUENT ANALYSIS, ppm

Hardness	as $CaCO_3$	0
Methyl-orange alkalinity	as $CaCO_3$	120
Chloride	as $CaCO_3$	27
Sulfate	as $CaCO_3$	88
Silica	as SiO_2	40

EFFLUENT ANALYSIS

% run	Phen alk as $CaCO_3$	M O alk as $CaCO_3$	Chloride as $CaCO_3$	Sulfate as $CaCO_3$	Silica as SiO_2
15	215	225	10	0–1	0.8
40	215	225	10	0–1	0.7
60	215	225	10	0–1	0.5
80	215	225	10	0–1	0.8
100	200	215	20	0–1	7.0

TYPICAL RUN for salt splitter when using 1.5 lb of caustic soda regenerant per cu ft anion exchange resin



RESULTS OF TESTS to find minimum amount of caustic regenerant needed. Note the decided temperature effect

Demineralizing

$$\begin{Bmatrix} H_2SO_4 \\ 2HCl \\ H_2SiO_3 \\ H_2CO_3 \end{Bmatrix} + 2A.OH = A_2 \begin{Bmatrix} SO_4 \\ Cl_2 \\ SiO_3 \\ (HCO_3)_2 \\ CO_3 \end{Bmatrix} + 2H_2O$$

Acids in cation effluent — Hydroxyl anion exchanger — Exhausted anion exchanger — Water

Chloride anion exchange

$$Na_2 \begin{Bmatrix} (HCO_3)_2 \\ SO_4 \end{Bmatrix} + 2A.Cl = A_2 \begin{Bmatrix} (HCO_3)_2 \\ SO_4 \end{Bmatrix} + 2NaCl$$

Sodium salts — Chloride anion exchanger — Exhausted anion exchanger — Sodium chloride

Hydroxyl anion exchange

$$Na_2 \begin{Bmatrix} (HCO_3)_2 \\ SO_4 \\ SiO_3 \\ Cl_2 \end{Bmatrix} + 2A.OH = A_2 \begin{Bmatrix} (HCO_3)_2 \\ CO_3 \\ SO_4 \\ SiO_2 \\ Cl_2 \end{Bmatrix} + 2NaOH$$

Sodium salts — Hydroxyl anion exchanger — Exhausted anion exchanger — Sodium hydroxide

ANION EXCHANGE EQUATIONS. Chloride anion exchange doesn't reduce silica—hydroxyl does reduce it

though. This reaction is shown in the third equation.

High ratio of hydroxide to other anions resulting from reaction in third equation would usually be objectionable for boiler feed. So it is necessary to convert part of the hydroxide back to sulfate by final sulfuric-acid treatment.

Equation three shows sodium silicate split to form sodium hydroxide. Our research work indicates, however, that the silica is adsorbed in its entirety. If silica had been converted to hydroxide in our tests at Brunswick, effluent hydroxide would have been 30 to 35 ppm higher than was actually found.

Salt splitting does not effect cations present. So hardness must first be eliminated or converted to sodium. For this reason, reactions given show influent salts in the sodium form. Sodium-zeolite treatment would accomplish this initial transformation.

Pilot-plant tests. Once the chemistry of the process was established, a pilot plant was set up to check its feasibility.

Caustic soda used. Boiler blowdown of about 10% of the makeup would be used in any case to keep total solids below 2000 ppm. On this basis, silica in makeup water could average 5 ppm so silica in boiler water does not exceed 50 ppm. So it was felt that caustic-soda regenerant used could be reduced sharply as compared to demineralizer practice where much lower silica content in the effluent is usually called for. Results of tests may be seen in graph above, which shows effect of gradually reducing caustic regenerant used as well as effect of using reclaimed regenerant effluent. Striking temperature effect is also shown.

As a result of the tests, it was found feasible to reduce the needed fresh caustic to under 1.5 lb per cubic foot of resin. (This compares with over 4 and usually over 5 lb per cubic foot needed in demineralizing.) Exchanger-run analysis table, above, gives influent and effluent analysis at various times during a typical run with 1.5 lb NaOH and caustic reclaiming.

Silica balance. Tests show that silica removed from the water does not exceed the silica regenerated off the resin.

Stability of resin. A total of over 115

Operating results and cost, equipment cost

		Hot-lime, zeolite			Demineralization		Sodium zeolite plus salt splitter			Hydrogen-sodium zeolite plus salt splitter			
OPERATING RESULTS, ppm	*Raw*	*After hot lime*	*After hot zeolite*	*10 blr concentrations*	*After demineralizer*	*100 blr concentrations*	*After Na_2Z*	*After anion*	*After acid*	*After H_2Z Na_2Z*	*After decarbonator*	*After anion*	*After acid*
Ca as $CaCO_3$	110	87	0–1		0–1		0–1	0–1	0–1	0–1		0–1	0–1
Mg as $CaCO_3$	94	10	0–1		0–1		0–1	0–1	0–1	0–1		0–1	0–1
Na as $CaCO_3$	31	26	121		0–1		233	233	233	128		128	128
Total cations	235	123	123		0–3		235	235	235	130		130	130
HCO_3 as $CaCO_3$	120	0	0		0		120	0	0	15		0	0
CO_3 as $CaCO_3$	0	25	25		0–1		0	20	20	0		20	20
OH as $CaCO_3$	0	0	0		0–1		0	205	20	0		100	5
SO_4 as $CaCO_3$	88	75	75		0		88	0	185	88		0	95
Cl as $CaCO_3$	27	23	23		0–1		27	10	10	27		10	10
Total anions	235	123	123		0–3		235	235	235	130		130	130
Total hardness	204	97	0–2	0	0–2	0	0–2	0–2	0–2	0–2	0–2	0–2	0–2
Methyl-orange alkalinity	120	25	25	250	0–2	200	120	235	40	15	15	120	25
Silica as SiO_2	40	3	3	30	0–0.1	10	40	5	5	40	40	5	5
CO_2 as CO_2	0	—	—	—	—	—	—	—	—	93	5	0	0
Total Solids	—	—	161	1610	3	300			320				180

MAIN CHEMICAL COST	*Lime*	*MgO*	*Salt*	*Acid*	*Caustic soda (NaOH)*	*Salt*	*NaOH*	*Acid*	*Salt for Na_2Z*	*Acid for H_2Z*	*NaOH for anion*	*Acid final*
Lb per 1000 gallons	1.20	0.25	2.0	6.2	5.0	5.4	3.0	1.7	2.8	2.1	2.3	0.9
Cents per lb	1.45	10	0.95	1.1	4.0	1.0	4.0	1.1	1.0	1.1	4.0	1.1
Cents per 1000 gallons	1.74	2.50	1.90	6.8	20.0	5.4	12.0	1.9	2.8	2.3	9.2	1.0
Total chemical cost per 1000 gallons, cents		6.14			26.8		19.3				15.3	
UNERECTED EQUIPMENT COST, $		90,000			170,000		110,000				130,000	

runs have been completed on the resin in the pilot unit. The resin was analyzed after this work and found to have full capacity.

Sodium zeolite, salt-splitting setup's operating results are shown in table above. The saving in fixed charges on a completely erected basis as compared to the hot-lime zeolite method roughly balances the greater chemical operating cost.

Hydrogen - sodium zeolite. Since Brunswick water has high alkalinity, and since the amount of caustic soda for regeneration is increased by this alkalinity, its elimination would still further reduce operating costs. Laboratory tests were made, therefore, with hydrogen-sodium zeolite. These tests showed slightly lower capacity of the anion exchanger, but the saving in caustic soda was appreciable. Table above gives operating data and costs. Simplified flow diagram of this proposed plant is shown on p 83.

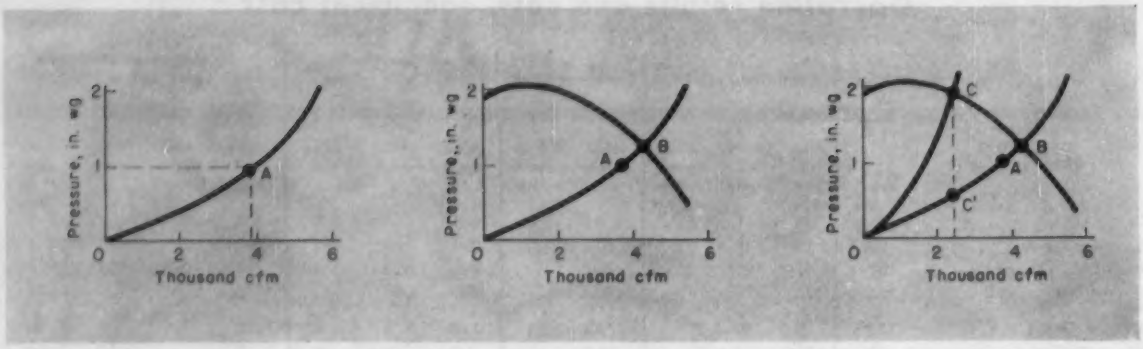
On an erected basis, the salt-splitter cost will usually be lower than the cost of the hot-lime zeolite setup.

The type of water most applicable to silica removal by salt splitting will probably have the following characteristics: high silica—over 20 ppm; fairly low solids (other than silica)—under 200 ppm.

The salt-splitting method will, as a byproduct, get rid of the bicarbonate content in the water by converting it to hydroxide. Thus the carbon dioxide in the steam is reduced to a minimum.

Conclusions. Results of this research project indicate that this new process of silica removal by salt-splitting anion exchange is thoroughly practical.

Its field of application will usually be for boiler pressures of 500 to 1000 psig and for raw waters rather high in silica and rather low in other dissolved solids. Operating cost will be lower than demineralizing but higher than hot-lime zeolite. Total investment on an erected basis will be lower than either demineralizing or hot-lime zeolite. Therefore, an economic study would have to be made to see whether saving in fixed charges as compared to hot-lime zeolite would counterbalance the greater operating cost.



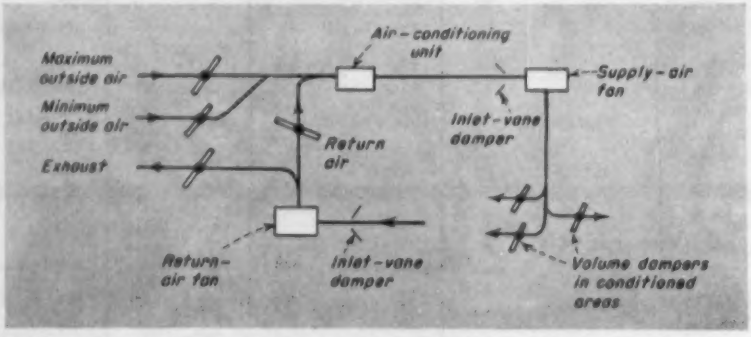
1 Typical system characteristic curve can be drawn through a known point

2 System curve placed over fan curve. *A*: known point, *B*: operating point

3 O-C: dampers at 50%, C: operating point, C-C': damper pressure drop

By J H COLBY*, *Branch Manager*
Johnson Service Company

Heating and air-conditioning control tests run at the John Hancock Building in Boston show . . .



5 Typical air-conditioning system with modulating volume dampers. This hookup is essentially the same as the one used in the John Hancock Building for tests

How air-velocity control licks

► TOP PERFORMANCE from your air-conditioning, heating or ventilating system—over a wide range of operating conditions—depends as much on well-designed controls as on the air-handling equipment itself.

Basically, good control is a matter of matching characteristics of the air-handling fan to those of the air-distribution system—at every possible operating point. Techniques for doing the job vary. And getting the right setup to meet system conditions isn't always easy. To find best means of getting this control, we ran a series of tests at the John Hancock Life Insurance Company Building in Boston, Mass.

The problem. No two air-distribution systems have the same characteristic curve. But we know their shapes are parabolic—pressure varying as the square of any change in air quantity. Thus, if we find a single point on the system curve, it's possible to extend it in either direction, see Fig. 1.

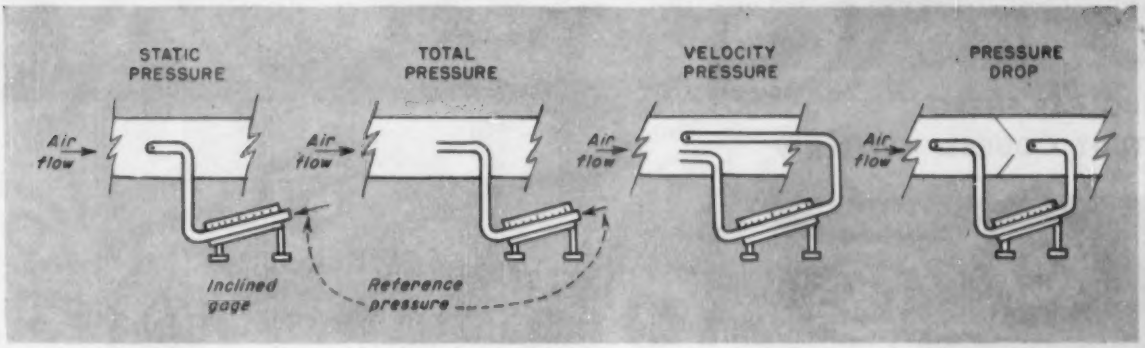
By placing this curve over a fan's constant-speed curve, we find pressure-volume conditions (at the intersecting point) that exist when fan and system are working together. This is the *only* operating point, Fig. 2.

Air flow to using areas varies because of: (1) Varying resistances—dirty filters, coils—within system. (2) Effect of varying wind pressures on outside-air intakes. (3) The closing or opening of automatic or hand-operated dampers. Change in any one of these gives system a new characteristic curve, *and* a new intersecting point with fan curve. Boost in resistance moves the point up, Fig. 3. Result: Fan delivers smaller volume of air at a higher pressure.

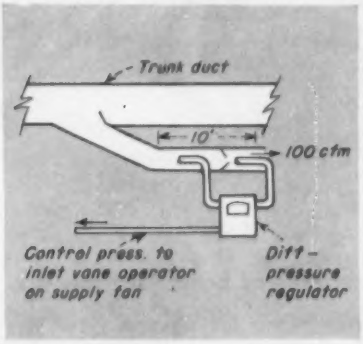
Reducing air volume to one half of normal flow cuts back duct resistance to about one fourth of its original value, resistance changing as the square of any change in air volume. If we get this by closing volume dampers, these dampers must do a two-fold job: (1) Set up added resistance needed by fan to deliver smaller air volume. (2) Compensate for drop in system resistance. Resultant high pressure drops across system outlet dampers gives us objectionable noise and drafts.

Measurement. Common ways of measuring various pressure quantities are shown in sketch, Fig. 4. Differential-pressure regulator can be used for control. But static- or total-pressure control shown, requires a reference point—usually atmospheric pressure. A small variation in ap has same effect as changes in static or total pressures themselves. So it's necessary to pick a ref-

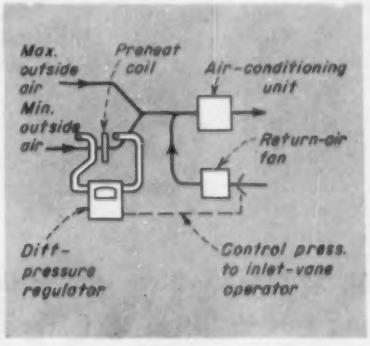
*Based on paper presented at First International Instrument Congress and Exposition of Instrument Society of America, 1954.



4 Measurement methods for static pressure, total pressure, velocity pressure and pressure drop. Closed-end gage tubes connect at right angles to flow. Open-end gage tubes connect parallel to flow. Inclined gage eases reading, boosts precision



6 Sampling duct for measuring velocity pressure or pressure differential



7 Minimum outside-air velocity control sensing preheat-coil pressure drop

noise and draft problems

erence point that's absolutely constant —a tough job that often makes control by static or total pressure a poor choice.

A close look at velocity-pressure and pressure-drop measurement in Fig. 4 shows that reference points are not needed here. And measurements are affected *only* by actual changes in velocity pressure or pressure drop at the point of reading. These quantities are therefore a first-rate source of accurate control signals.

Tests on a system, identical to Fig. 5 at John Hancock Building, pointed to best way of varying supply and return-fan characteristics. (Remember, fan curves must cross system curves at points that give air flow called for by outlet dampers in conditioned areas.) Automatic dampers in the maximum-outside-air and exhaust ducts work together in this system. When maximum-outside-air damper opens, exhaust damper opens and return-air damper closes. Also, air flow to conditioned areas automatically varies with needs.

About 100 outlets, each furnished with automatic damper, are controlled by thermostats in the conditioned space.

First test run was without automatic control on supply fan. We took velocity-pressure readings on a sample outlet damper *before* and *after* all other outlet dampers were throttled 50%, see table, right. Terrific increase in velocity pressure across sample damper—more than 200% when all other dampers were closed 50%—caused big boost in air velocity, resulted in air noise.

Adding static-pressure control on supply fan, we ran the same before-after tests. Even with constant static discharge pressure on supply fan, table of test data shows that velocity pressure across the sample damper climbed

(*Continued on page* 220)

TEST RESULTS

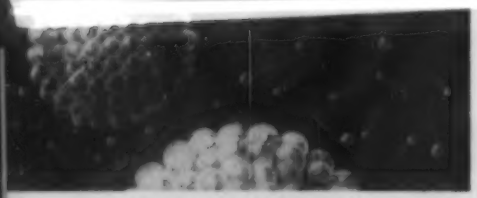
Air-handling control

Position of all dampers	Velocity press. through sample damper, in.	Supply-fan-disch static press., in.
TEST 1		
No automatic control on supply or return air fan. 30,000-cfm system supplying 100 units with damper controls		
Open	Damper open — 0.10 Damper closed—0.14	0.57
Closed to 50% min	Damper open — 0.33 Damper closed—0.40	0.77
TEST 2		
Static-pressure control on supply fan		
Open	Damper open — 0.10 Damper closed—0.14	0.57
Closed to 50% min	Damper open — 0.23 Damper closed—0.29	0.57
TEST 3		
Velocity control on supply fan		
Open	Damper open — 0.10 Damper closed—0.14	0.57
Closed	Damper open — 0.10 Damper closed—0.14	0.32

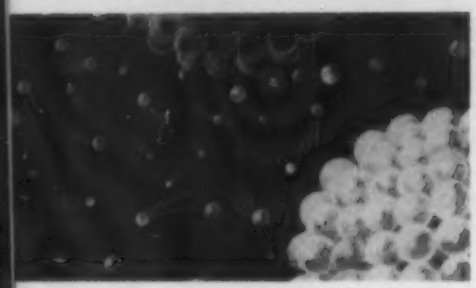
TEST 4

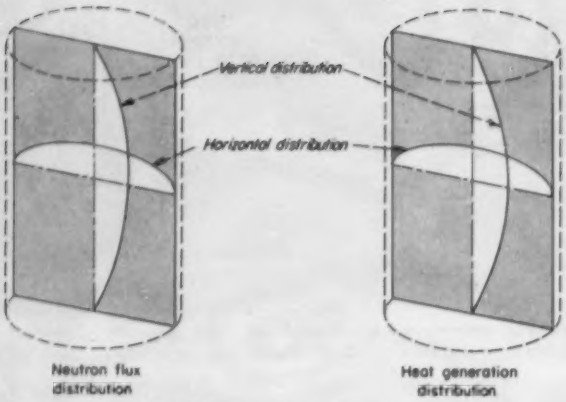
Velocity control on supply fan. Readings taken at random dampers, with supply-fan inlet vane under velocity control from sample damper at 0.098 in.

Random damper location, floor	Velocity pressure, in.	Supply-fan-disch static press., in.
23	0.08	0.4
23	0.13	0.4
24	0.12	0.4
25	0.08	0.35

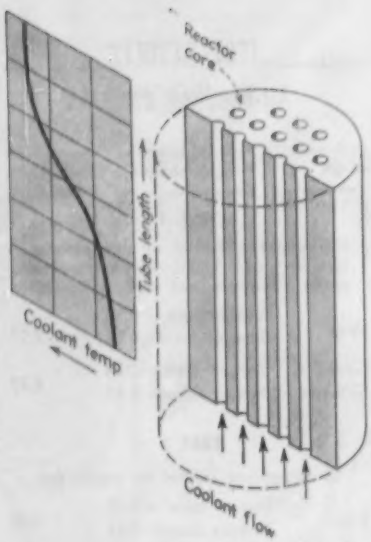


NUCLEAR-ENERGY STUDY COURSE: NUMBER 9

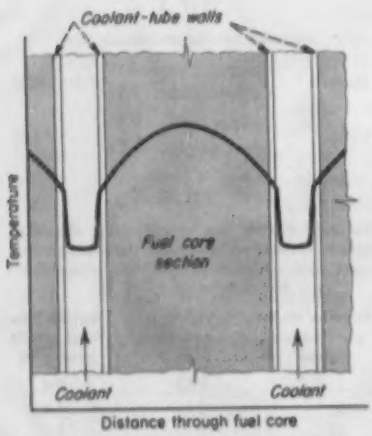




1 Fissioning of U-235 is the highest at the core center, so neutron flux and heat generation follow the same pattern



2 Coolant temperature rises at fastest rate when it passes near core center



3 Fuel core center runs at higher temperature than does the fluid coolant

Up to now we have studied the actions of basic particles taking part in fission chain reactions. Now let us see how the groups of particles are put to work in . . .

Nuclear power reactors and their parts

By **HENRY C SCHWENK**, *Henry Pratt Company*
and **ROBERT H SHANNON**, *United Engineers and Constructors, Inc*

► NUCLEAR REACTORS are built in many ways: about 80 different designs have been proposed as possibilities. We can sort all these designs two ways, according to the nature of:

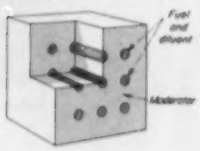
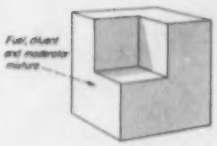
1. Neutron energy that will cause nuclear fission.

2. Physical arrangement of fissionable material, diluent and moderator. An example of a diluent is U-238 in natural uranium, the U-235 being the only fissionable part. Table 1 shows the classification of reactors, together with a brief outline of their relative advantages and disadvantages.

There are many additional factors not shown in Table 1. For instance, the schematic sketches of the heterogeneous and homogeneous cores do not show the coolant passages, control rods and structural features.

Heat production is our main interest in the nuclear reactor. We must know how heat is generated in the core and then removed. In Part 7, p 89, Feb 1955, we note that about 173 out of 200 mev

TABLE 1—CLASSIFICATION OF NUCLEAR-POWER REACTORS

Neutron energy		Physical arrangement	
Thermal	Fast	Heterogeneous	Homogeneous
			
Neutrons sustaining chain reaction are at energy level equal to gas molecules at same temperature. Energy less than 1 ev.	Neutrons sustaining chain reaction have about same energy level as when they are thrown out of nucleus. Energy above 0.5 mev.	Fissionable material, diluent and moderator (if used) are all in solid state, and arranged in a fixed pattern.	Fissionable material, diluent and moderator (if used) are all in a liquid slurry, or may even be in paste form.
ADVANTAGES			
Considerable experience available because most reactors built to date are of this type. Amount of fissionable material needed is smaller for given power output. Almost any coolant can be used to remove heat.	Physical reactor size is smaller for given output. Reactors have more possibilities as converters or breeders. This raises possibility for economical nuclear-power stations.	Materials for coolant passages in reactor are available. Fuel material and moderator can be arranged in fixed pattern, giving more uniform performance.	Reprocessing of spent fuel material and adding of new fuel can be carried on continuously. Except for material problem, the reactor might be easier to design and construct.
DISADVANTAGES			
Physical size of reactor larger for given output. More difficult to design good converter or breeder.	Only one reactor built to date. More fissionable material needed for given output. Coolants limited to nonmoderating fluids.	Reactor has to be shut down to change fuel elements. Radiation damage distorts elements. High cost of fuel processing, reprocessing and inventory.	Severe corrosion shortens life of available materials. Diluent and moderator must be handled during reprocessing. Hard to keep mixture uniform.

(86%) of fission energy immediately appears as heat energy. Assuming a uniform mixture of fissionable material we have a neutron flux distribution in a cylindrical core, as shown in Fig. 1. Neutron flux is a measure of the density of free neutrons and their velocity.

Heat production depends directly on the neutron flux, which causes the fissioning, so the heat-generation pattern, Fig. 1, follows exactly the same pattern. This means that heat generation is highest in the core center and tapers off to zero at the core surfaces.

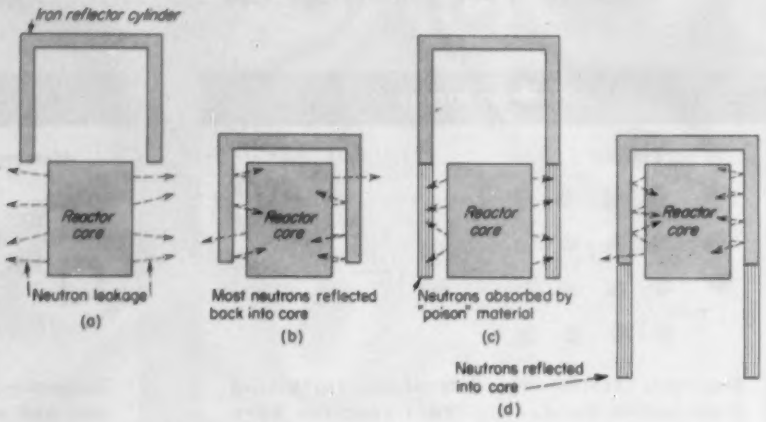
Heat removal from the core depends primarily on conduction and convection. Usually a fluid, called a coolant, flows through tubes embedded in the core, Fig. 2. A pump forces the coolant through the reactor. The coolant temperature rises fastest when it passes near the center of the core where heat is being produced fastest, as shown in the graph next to the reactor core.

Fig. 3 shows the temperature changes through a section of core and the coolant. To transfer heat energy the fuel element's temperature must be higher than the coolant's. For many liquid coolants, such as water, we must always deal with the large film-temperature drop at the tube surface.

Since heat is being generated throughout the fuel element, its center is much hotter than the part next to the coolant tube. This adds to designing problems. The fuel element mustn't get so hot that it becomes soft or plastic.

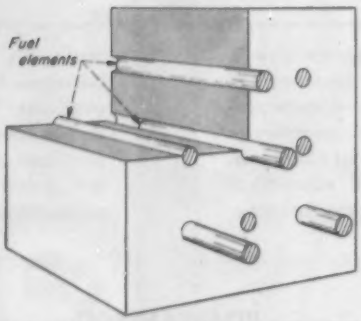
Coolant choice depends on a number of factors:

1. Nuclear properties.

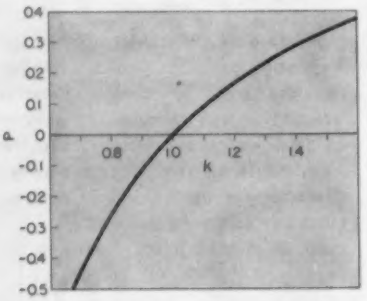


4 Movable shield-type reflector can control reactivity of reactor by varying the number of leakage neutrons bounced back into the core; in c neutrons absorbed

Reactor power level can be changed by control of neutron leakage, neutron absorption and amount of fuel in core



5 Moving solid fuel elements in and out of core varies the reactor power level



6 When reactivity *P* is zero a reactor runs at steady energy output, k = 1

2. Materials' heat-transfer properties.
3. Heat capacity.
4. Stability under temperature and nuclear radiation.
5. Handling and containment problems.
6. Pumping power.

Table 2 lists some of the possible fluids and shows how they compare in these respects.

Another approach lets water boil to steam in the reactor. The steam directly drives a turbine. The primary problem here centers on the danger of radioactive particles being carried over in the steam. They can contaminate the entire steam system and its auxiliaries.

Gases like air and helium can be used as coolants. The most severe problems for gas coolants are heat flux, fuel-material limitations and gas-film resistance. These tend to raise the amount of fissionable material needed in the reactor and the temperature of the fuel elements. Pumping power may run high.

Only fluids that do not contain hydrogen, carbon, or other moderating elements can be used as coolants in fast reactors. Moderating elements thermalize neutrons, increasing the probability of their engaging in fission reactions. Too much thermalizing might make the reactor run out of control. Water and Dowtherm cannot be used in a fast reactor. On the other hand, coolants with moderating elements can be used in thermal reactors.

Other factors being equal, cost and availability control the choice of a coolant. It must be relatively cheap and available in the quantities needed. Chemical suitability also plays a big part. There are exothermic (heat-producing) reactions between water and the alkali metals, like sodium, potassium and lithium. Water and aluminum also produce an exothermic reaction at certain temperatures. Uranium oxidizes very readily in water. This, however, is not as potentially dangerous as the exothermic reactions.

Controls. In a steam-electric plant we vary the fuel supply to regulate the steam output of the boiler. In a reactor we must control the fission rate to regulate the heat output. At all times we must keep the neutron flux (the number of neutrons in a unit volume in a unit time) at a level to match the load.

Let us look more closely at neutron behavior. We find there are two kinds:

1. Prompt neutrons.
2. Delayed neutrons.

About 99.25% of the neutrons are thrown out of the nucleus in about 10^{-14} seconds, practically instantaneously, after fission takes place. These are the prompt neutrons. The remaining delayed neutrons, about 0.75% leave the fissioned nuclei fragments over a period of minutes.

No control system can handle the short time factor of the prompt neutrons. So control systems are designed on the basis of handling the delayed neutrons. Reactor control depends on the following relation between neutrons:

Neutron production
–neutron leakage
–neutron absorption
= Net excess neutrons

TABLE 2—HOW FLUIDS COMPARE AS COOLANTS FOR NUCLEAR REACTORS

Fluid	Nuclear properties	Heat-transfer properties[1]	Volumetric specific heat, Btu/ft³/F	Stability under temperature and nuclear radiation	Handling and containment	Relative pumping power
Pressurized water system:						
Light water	Good	Good	74	Some dissociation	No serious problem	1.0
Heavy water	Good	Good	82	Some dissociation	No serious problem	1.1
Sodium (Na)	Good	Excellent	17	Stable	Chemical reaction with water. Burns in air. Material problems	1.04
Sodium-potassium alloy (NaK)	Poor	Good	14	Stable	Chemical reaction with water. Burns in air. Material problems	0.99
Lead-bismuth alloy	Good	Good	23	Stable	Material problems	11.1
Lithium[2]	Poor	Very good	31	Stable	Same as for Na and NaK	0.68
Mercury	Very poor	Good	26	Stable	Material problems	12.7
Dowtherm	Good	Poor	35	Unstable	—	—

1—Based on thermal conductivity and heat-transfer film coefficient. 2—As found naturally.

Both fission and nonfission types are included in neutron absorption. To sustain a constant-level chain reaction (be just critical) the net excess neutrons must be zero.

Reactor power level may be controlled by varying:

1. Neutron leakage from reactor core.
2. Nonfission absorption of neutrons.
3. Amount of fuel in reactor core, which changes the number of neutrons produced.

Neutron leakage can be controlled with a reflector. The reflector, perhaps made of iron, surrounds the core. By a scattering process, most of the neutrons are bounced back into the core. Fig. 4 shows how a reactor might be controlled by a movable reflector.

Nonfission absorption can be controlled by adding another section to the cylindrical reflector as shown in Fig. 4c. The material in this section would be a "poison" like boron or cadmium.

Fig. 5 shows how we might control a solid fuel (heterogeneous) reactor by moving the individual fuel elements in and out of the core.

Reactivity. In Part 8, March 1955, on the chain reaction, we learned that we had to produce the same number of neutrons in successive units of time to maintain constant power production. In other words, successive generations of neutrons had the same number of neutrons.

To shut down a reactor we simply keep reducing the number of neutrons in succeeding generations. To start up, we let the neutrons increase in succeeding generations until we reach the power level wanted. This must be done with the controls, whatever form they take.

In Part 8 we met the multiplication factor k, which is the ratio of the number of neutrons in one generation to the number in the preceding generation. When $k = 1$, a chain reaction proceeds at constant level; when k is less than one, reactor power decreases; when more than one, reactor power rises rapidly because each neutron produces more than one new neutron.

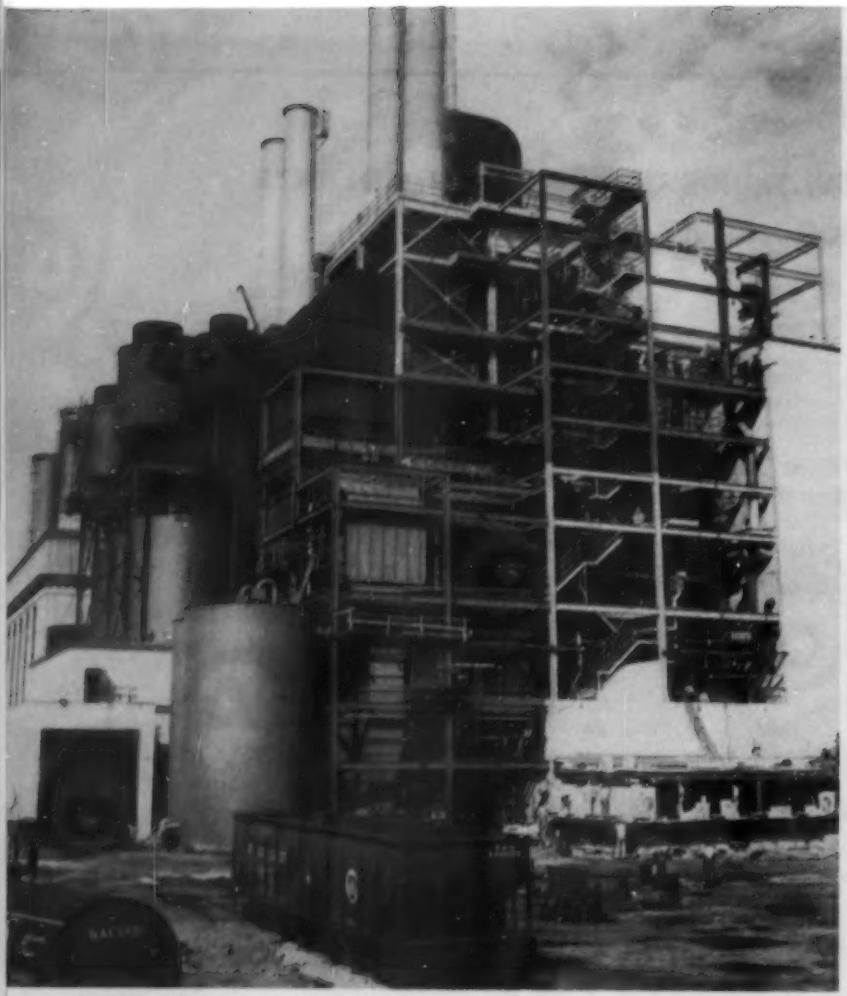
In control studies, *reactivity* P is calculated by the following formula:

$$P = \frac{k-1}{k} = 1 - \frac{1}{k}$$

When $P = 0$, reactor power stays at a steady level; when it is positive, reactor power increases; when negative, reactor power decreases. Fig. 6 shows how P varies with k.

A unique feature of reactors is the fact that they continue producing heat for a short time even after they are shut down. Radioactive decay and delayed neutrons cause this effect. The coolant must remove this heat or reactor temperature may exceed safe limits. This is a new practice that operators will have to learn in nuclear-fired plants. In emergency shutdowns the heat picked up by the coolant must be dissipated to some safe place. This might call for emergency coolers in the steam cycle.

The next article will cover: shielding, heat utilization and steam-power cycles —in a forthcoming issue.



EXTERIOR VIEW of two Babcock & Wilcox 875,000-lb-per-hr 1800-psi 1000/1000-F semioutdoor boilers: units 7 and 8, Delaware Station, Philadelphia Electric Co

CLOSEUP of air-heater insulation: two layers of mineral wool; wire netting

INSULATING cement troweled over wire netting on boiler-casing wool blocks

Latest practices in...

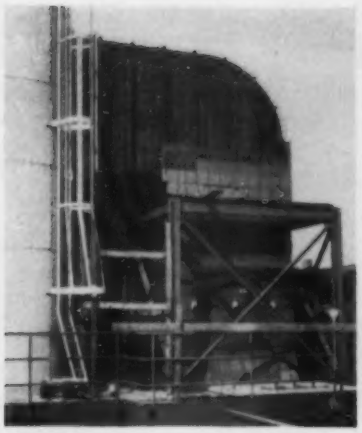
Insulating semioutdoor boilers

By **JOHN BARNHART**, *Executive Director, Industrial Mineral Fiber Institute, Inc*

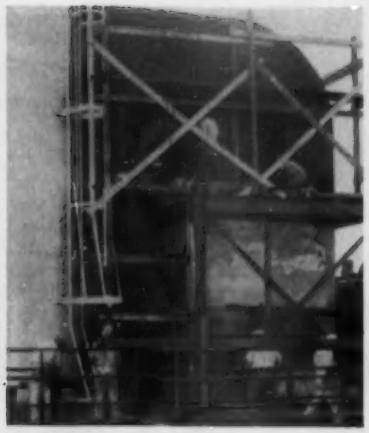
► UNITS NO. 7 AND 8 at Delaware Station, Philadelphia Electric Co, have semioutdoor boilers. (For engineering details see POWER, Sept '54, pp 96-99.) Insulation of the boilers and piping is extremely interesting because a number of knotty problems were met and successfully solved in this utility plant.

Requirements. During construction of outdoor plants, insulation must be sufficiently weather-resistant to be structurally stable. Other important requirements for insulation are low-moisture absorption, ease of installation and a K factor that is not adversely affected by the weather. Failure to meet one or more of these conditions can increase job costs.

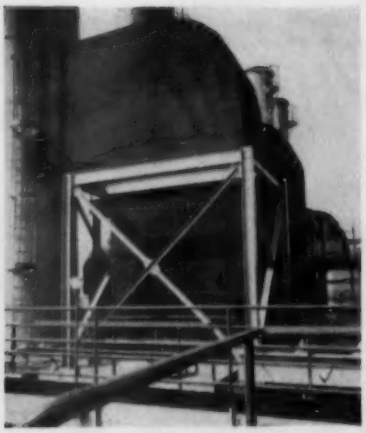
Economics. Heat conservation is more important in outdoor and semioutdoor plants than in housed ones. So choice



I-D FLUE connection to stack shows road mesh and two layers of wool block



MASTIC being applied over cement on mineral-wool block on the stack flue



COMPLETED stack flue is covered with sprayed skin of weatherproofing mastic

COMPLETED boiler casing shows mastic weatherproofing over the scored cement

BOILER access door after mastic spray, *left;* same, before mastic spray, *right*

FAN casing and intake insulation before the wire netting and cement are applied

of the most economical thickness for the insulation is a more critical decision. Weather conditions, plant location, fuel cost and operating temperature of the equipment all affect the most economical thickness.

Besides its thermal properties, insulation for outdoor plants must be rugged enough to withstand high wind velocities, drenching rains, snow loads, radical temperature changes, and normal abuse (personnel often walk on insulation and drop tools on it). During and after its installation, anchors may be subjected to severe loads.

Weatherproofing. Both metallic and mastic weatherproofing materials are available for outdoor boilers. At the Delaware Station a sprayed mastic membrane was chosen because it appeared to have a number of advantages over metallic weatherproofing, especially for maintenance. Subsequent operation has verified the validity of this decision.

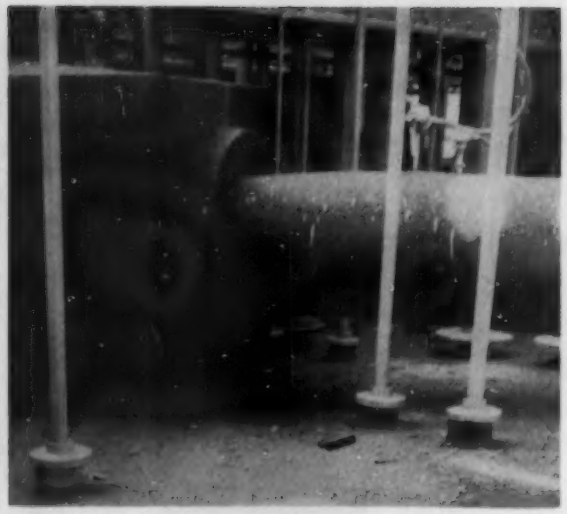
For best results a mastic membrane must, among other things, be continuously plastic to permit insulation movement, be impervious to moisture and acids in the atmosphere, be nonoxidizing (resistant to ultraviolet and infrared of sunlight), have sufficient film strength to withstand high winds, have high adhesion without reinforcement and, depending on the application, be able to withstand temperatures to 600 F.

Other required properties include structural strength, easy sealing at the joints, and low first and applications costs.

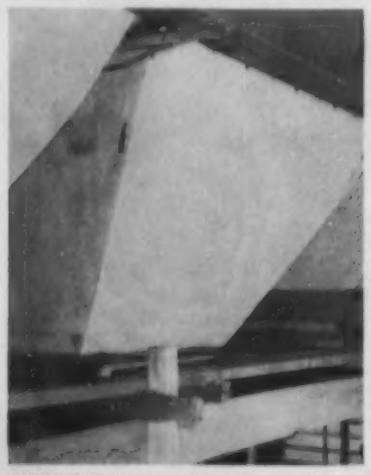
Insulation. This station is an interesting example of using mineral-wool block insulation in conjunction with mineral-wool flyash-base insulating finishing cement protected by a mastic-

STRETCHING poultry netting over mineral-wool insulation on the boiler casing

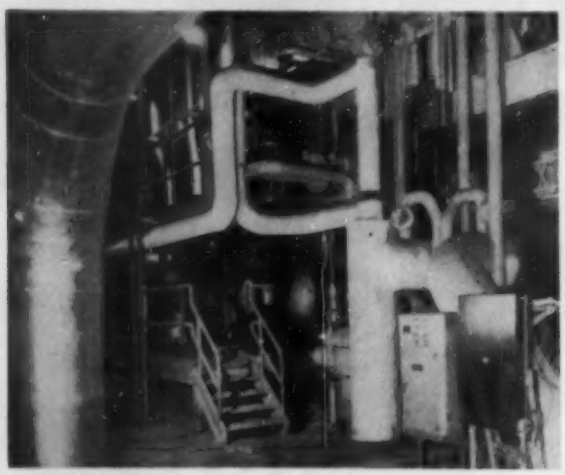
STEAM-LINE insulation after spraying with weatherproofing mastic compound



LARGE AREA of boiler roof casing is exposed to the weather. Cement, 3-in. thick, covers grating, with mastic over this



INSULATED hoppers below dust collectors will be sprayed with weatherproofing



BOILER DRUM and casing after application of the weather-proofing mastic to these surfaces. Note boiler access doors

membrane weather-proofing for boiler, fans, ducts and the outside piping. Operation to date proves the combination of specific materials satisfactory for heat-loss reduction, minimum maintenance, elimination of painting, and ease of structural changes after boiler erection.

Major changes were made in soot-blowing equipment and piping without excessive insulation replacement costs or labor. Canvas jackets have been eliminated on all piping with an internal temperature of 600 F or higher. Mastic membrane is used instead, reducing finish maintenance. On 1050-F piping, temperature of insulation exterior does not exceed 120 F.

Power
MODERNIZATION PROGRAM

How to submit entries →

Winners at Diamond Alkali Co:
L to r—F H Rockwell, chief project engineer, Central Engrg Dept; N J Braski, plant engineer; G J Orosz, project engineer, Central Engrg Dept; Howie Kallen, POWER; C H Shie, works engineer; R C Sutter, chief engineer, Painesville Central Engrg group; T R Day, assistant superintendent, Power Dept

Don't miss this chance to win recognition

► ENTRIES for POWER's 1955 Modernization Award program close May 15. If you completed a renovation job during 1953 or 1954, here's your chance to win recognition for your accomplishments—recognition in the pages of POWER, recognition in the form of a citation to be displayed proudly in your plant. To grasp this opportunity, read the simple entry instructions below and act on them now.

Last year's program demonstrated conclusively that modernization pays—the 18 plants receiving awards piled up annual savings of over $3 million per year. And it proved that modernization pays right across the board—in steam and power generation, in electrical distribution, in heating, air-conditioning, refrigeration and compressed-air systems.

This year's program promises to be even bigger and better. To take your place in it only one step is required. Ask for an entry blank to summarize your results.

Remember, entries may be made for any type of plant—steam, diesel or hydro—in any service—industry, institution or utility. Modernization may involve the entire power-service system, or any major part of it. Small projects will receive the same consideration as large ones.

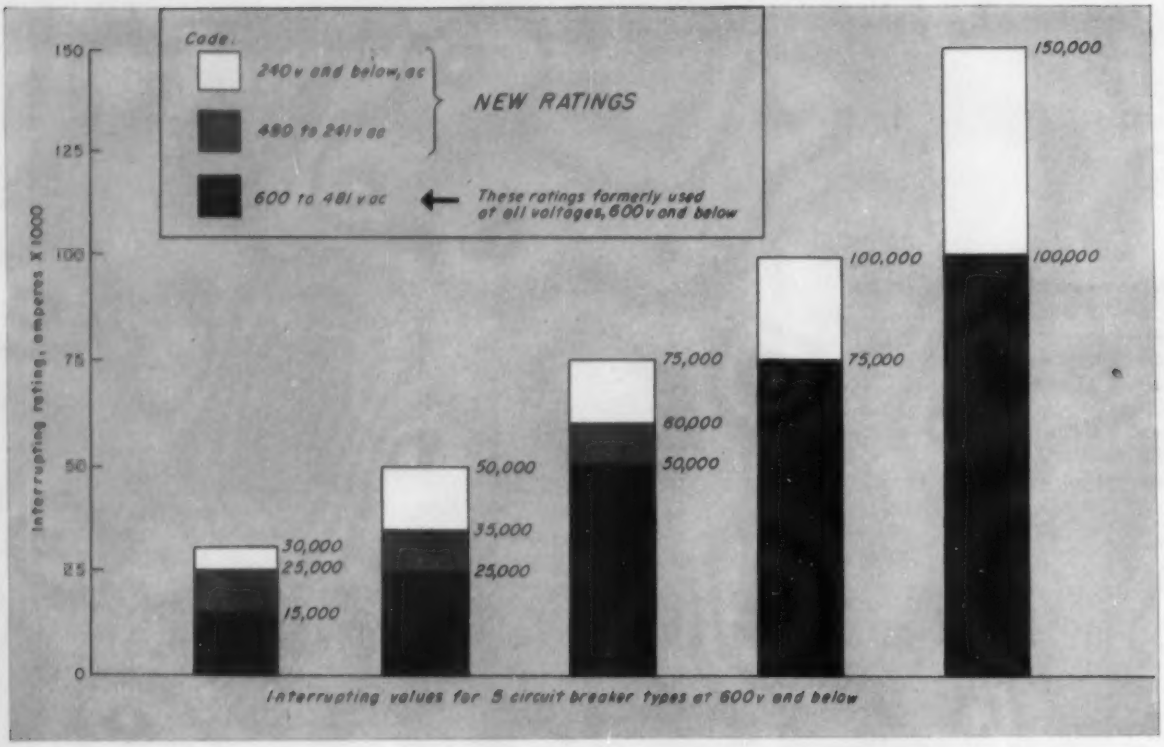
So if your plant qualifies, be certain to read the simple instructions below. Send for your entry today, while there is still time.

---

1. Entries may come from plants of any type, of any size, in any service, where a modernization program was completed in 1953 or 1954. Modernization may cover entire power-service installation, or any major part.
2. Entries may be made by any responsible member of a plant staff, or by a consultant for his client.
3. To enter, just say "I'd like a 1955 Modernization Award Blank" and address your postcard or note to:

   Modernization Award Committee
   c/o POWER
   McGraw-Hill Publishing Co, Inc
   330 West 42nd Street
   New York 36, N. Y.

4. The streamlined entry blank makes it easy for you to tell us about your modernization: (1) what was done (2) the reasons for it (3) the results (4) unique features of the job (5) what unusual problems were encountered and solved.
5. Entries will be received to May 15, 1955. Announcement of awards will be made in the 1955 Mid-September *Modern Plant* issue.
6. Arrangements for presentation of awards will be made to suit the mutual convenience of the recipients and the POWER staff.
7. There is no set number of awards. It is our intention to recognize all plants that have carried out modernizations of outstanding merit.



Manufacturers boost IC ratings 50%

• NEMA committees have long been considering adoption of higher interrupting ratings for large 600-v air circuit breakers when applied at 240 and 480 v

• Circuit-breaker manufacturers have recently announced just what these higher values are. And it all adds up to a tidy possible saving for the circuit-breaker user

► FOR SEVERAL YEARS circuit-breaker manufacturers have been jointly probing the feasibility of stamping a more realistic interrupting-capacity rating on large low-voltage air circuit breakers. Until about six weeks ago, IC rating leveled for 600 v was the recommended value to use at 240 and 480 v.

But circuit-breaker design engineers have long suspected IC ratings could be boosted on 600-v air breakers applied at lower voltages. And manufacturers' recent lab tests have pinned down actual practical values for the increase.

Higher values for IC ratings were announced by individual manufacturers before final approval was pinned down by NEMA as a body. Little doubt exists, however, that the extended ratings (chart above) will become an industry standard. Four of the major circuit-breaker manufacturers — Allis-Chalmers, General Electric, I-T-E, Westinghouse—have announced that their present line of large air circuit breakers will meet the extended IC ratings at the lower voltages.

Briefly, this passes along to users of this type breaker some facts that recently came to light in manufacturers' labs*. Now, subject to specific limitations, it is possible to install less costly breakers in low-voltage applications.

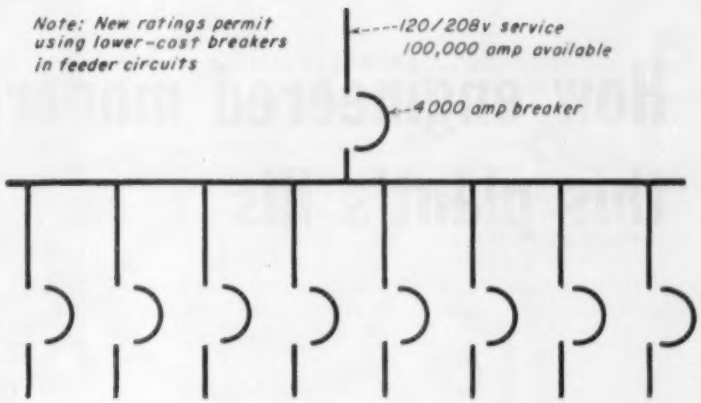
*Circuit breakers involved in this uprating are the large air types in the low-voltage class. Typical are Allis-Chalmers type *G*; General Electric *AK-1*; I-T-E type *KA, KB, KC, LG*; Westinghouse *DB*. Two additional manufacturers in this same NEMA group, Roller-Smith and Federal Pacific, are not commenting on their plans at this time.

Here's one example of savings possible through higher IC ratings

Using the setup, right, GE engineers estimate 30% can be saved on cost of breakers. Here's how: With old IC ratings, main breaker is 4000-amp type *AK*-1-100. Then assuming eight 600-amp feeder circuits, eight electrically operated *AK*-1-50 air breakers are applied in cascade. Estimated total price for indoor drawout breakers, $25,200.

With new higher IC ratings, main breaker is same type, but feeder breakers become *AK*-1-25's; still cascaded. Estimated price, now $17,600. This shows up as $7600 difference or 30.2% savings. *These figures hold for all major manufacturers.*

Remember, breakers are connected in cascade simply to cut first cost. It's possible for main and feeder breakers in cascade to open under a heavy short.


Note: New ratings permit using lower-cost breakers in feeder circuits
120/208v service
100,000 amp available
4000 amp breaker
Note: Feeder breakers are cascaded.
All feeder circuits are 600 amp

on some low-voltage circuit breakers

And the low-voltage field is really big: 90% of all breakers applied in commercial buildings and industrial plants are at 480 v and below. As a rough indicator of possible savings, you may realize a 27% cut on the cost of switchgear in a typical 1000-kva load center unit. There is no announced change in basic breaker prices.

General Electric engineers point out that this change affects no ratings determined by current alone, such as *short-time, close-and-latch,* and *continuous current.* And there is no change for breakers applied at 600-v ac or 250-v dc. GE also indicated this increase in interrupting rating is limited to breakers having dual magnetic trips (long time—instantaneous). *Breakers equipped with selective trips are not affected: They should not be applied above their short-time rating.*

It's now possible to get breakers in some IC categories with lower continuous ratings than were available before at 240 and 480 v. Example: Smallest continuous rated 75,000 IC breaker was formerly 2000 amp. Under new IC ratings you get a 600-amp breaker at 240 v having a 75,000 amp IC—such as GE's *AK*-1-50 or Westinghouse *DB*-50. Basically, the breaker-selection technique has not changed. For a condensed version of modern circuitbreaker application practice, see POWER Oct 1953, p 106.

Quite naturally, you will meet up with distribution systems where the breaker type being considered will satisfy the IC requirement, but it may not be large enough to handle continuous current needs. Standard practice here is to use the next-larger-type breaker.

Word of caution is introduced by I-T-E engineers that bus, bracing, related equipment must still meet short-circuit needs. Remember, allowable IC for the current breakers does not influence this latter portion.

I-T-E points out further that certain ground rules must be adhered to when planning to take advantage of the higher IC values. Here are typical limitations: (1) Breakers must be equipped with instantaneous trips set no higher than 1500% of coil rating for their *KA, KB* and *KC*—and 1200% for their type *LG.* (2) Cascading is limited to two steps at 480 and 240 v, and within specified limits. (3) Selective trip applications are limited to 600-v IC ratings. (4) Short-time ratings are equal to 600-v IC rating. (5) For other than 50 or 60 cycles, use 600-v ratings only.

Since there was no fundamental change in the breakers involved, what about the allowable IC rating on breakers now installed? Where the breaker is the same type and design as those now being sold, uprating might be OK. But before deciding, check this point with the specific breaker manufacturer.

With the fast growth of available short-circuit current in utility lines and industrial-plant generating equipment, this up-rating of maximum safe IC values for installed equipment should be given much consideration. Sometimes it may mean a considerable saving through continued use of breakers now verging on the old IC limit.

A 1954 award winner

A CASE STUDY:

How engineered modernizing cured this plant's ills

Faced with smoke violations and costly power services, Motor Products Corp decided it was high time to modernize. And smart engineering made it pay off

Here's the $ picture

Item	*Investment*	*Annual savings*
Air compressor	$78,000	$26,000
I-d-fan motor, insulation, draft controls	4,900	12,400
Ash handling	41,000	5,800
Coal handling	33,000	8,400
Stokers	32,000	—
Deaerating heater	17,000	1,600
Total	$205,900	$54,200

► IT'S NOT ALWAYS necessary to make a multimillion dollar investment to reap the benefits of a smart modernizing program. Far from it. Many of today's best renovating efforts are handled with small- and medium-sized $ outlays. Spotting such jobs isn't hard either. They're usually earmarked by that "something extra"—clever arrangement, adapting old units to new systems, attractive cash returns, etc.

The job by Motor Products Corp, automotive-parts manufacturer, fits this description to a tee. Faced with an overloaded and poorly operating compressed-air system, smoke-ordinance violations, poor boiler control and inefficient coal and ash handling, they called in local consultants Boddy, Benjamin & Woodhouse, Inc to make an exhaustive study. Company engineers worked hand in hand with BB&W, reported these system weak links:

Compressed air. Two electrically driven 500-hp air compressors were operating too close to maximum capacity—often on a 3-shift basis. To make matters worse, intake air was heavily laden with flyash, scoring compressor-cylinder surfaces.

Ash handling. Two boilers, dump-grate spreader-stoker-fired, discharged their flyash from tubular dust collectors into an old 175-ft brick chimney. While the chimney wasn't connected to other equipment, MPC received several smoke-violation notices. The stack's natural draft was causing heavy flyash emission. Also, stub stacks were discharging boiler flue gas just below a large new "Motor Products Corp" sign.

Operators removed ashes from the stoker pit manually. A small drag conveyor pulled ash across the cellar floor to a bucket elevator that deposited its ash load directly on the ground. After raking flyash from the old chimney, through a clean-out door, operators crane-loaded both flyash and bottom ash onto trucks—a time-consuming step that created dust problems.

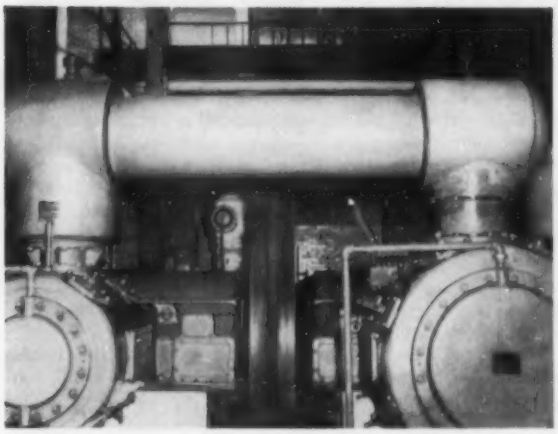
Coal-handling system was short on bunker capacity, mainly because the bunker-feeding screw conveyor was directly atop and off center of the bunker. Result: Loss of about 35 tons of active storage. In addition, unloading, stocking out, reclaiming and loading coal, all handled by crane, wasted valuable time, proved costly.

Draft control. Oversized outlet dampers pushed low-load draft regulation way out of line, boosting stack-gas temperatures above reasonable limits, wasting Btu's. And uninsulated boiler surfaces further aggravated the problem.

Feedwater. Cavitation was eroding a relatively new boiler-feed pump. Close check showed that net positive suction head was too low. To add to feedwater troubles, deaeration was virtually nonexistent. Feed heating was done in an old (1910) cast-iron tray-type heater. Corrosion had long since removed even the tray supports. And condensate lines were, naturally, in poor condition. Also, possibility of oxygen pitting in boilers had to be dealt with.

In brief, plant conditions called for quick, positive action. Following paragraphs show how MPC engineers, working with BB&W, turned this "company sore spot" into a clean, efficient, $-saving operation.

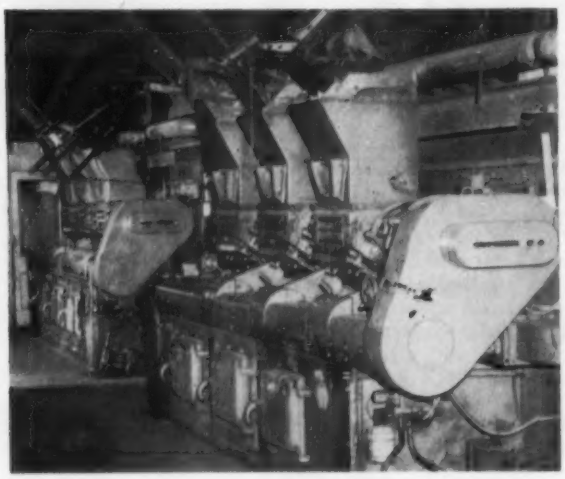
Power acknowledges cooperation of R B Gilroy, Plant Engineer, Motor Products Corp, and M W Benjamin of Boddy, Benjamin & Woodhouse, Inc, in supplying information for this article.



Compressed air . . . cheaper

Elevating air intakes 60 feet to powerhouse roof now insures clean air to compressors, practically eliminates chance of cylinder scoring because of entrained flyash.

Heavy demand for low-pressure process steam made choice of steam-driven air compressor—to boost service-air capacity—look attractive. Savings were even better than expected. At full load (3000 scfm) the unit saves $4.63 per hour over motor-driven operations, for a yearly savings of $26,000. Compressor, left, cost $78,000 installed. Pay-out time for the outlay: less than three years.

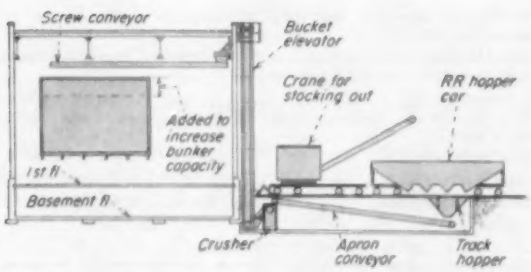


Firing . . . cleaner

Installation of a second 3-speed 50-hp i-d fan motor, along with new draft controls and insulation of some exposed boiler surfaces, cost $4900, yielded annual savings of $12,400. Then, to improve low-load operation, MPC blocked open the old oversized dampers, added a throttling-type damper, built in their own shop. Net effect was to cut back stack-gas temperature by 80 F, improving firing efficiency.

Light-load summer-weekend operation, with existing firing equipment, wasn't good. In fact, smokeless operation was virtually impossible. And ash-dumping always produced excessive smoking.

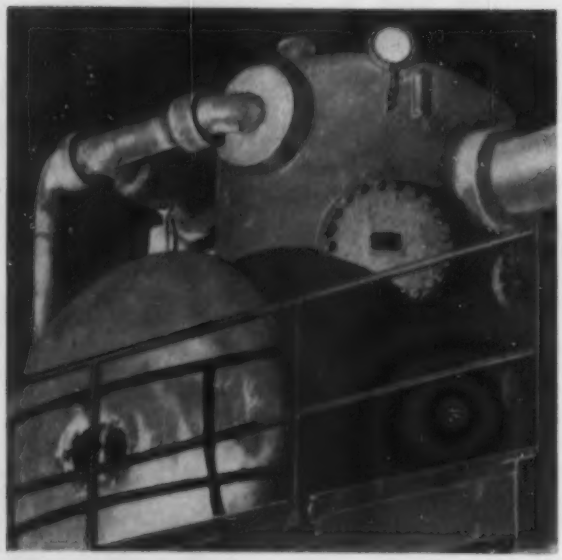
Installing new continous-ash-discharge spreader stokers licked the problem. Unit uses alternate rows of reciprocating grates to discharge ash and agitate fuel bed, improving combustion-air distribution. High-pressure overfire-air fan and existing cinder-return system complete the installation.



Coal handling . . . simpler

Old crane-handling methods were replaced with a completely new time-saving system, left. Railroad hopper car, feeding track hopper, empties coal into apron conveyor. From here coal goes to crusher and bucket elevator, discharging to existing screw conveyor over bunker. Engineers picked up more storage space by raising and centering screw conveyor over bunker. System sketch also shows how increasing bunker height ups storage space even more.

Locomotive crane shown is now used for stocking out.



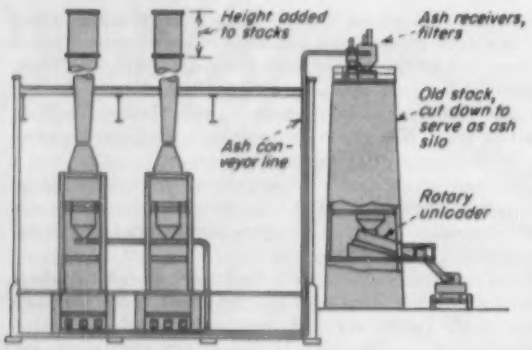
Feedwater . . . more reliable

Existing water treatment was, for all practical purposes, internal only. Organic phosphate mixture was injected into boiler drums at timed intervals. Cost for this treatment, plus blowdown losses, was about $1100 a year.

Careful study by BB&W considered hot-lime-soda or sodium-hydrogen-zeolite softening. But pay-out times for both these proposals were far from attractive. Most economical solution proved to be a new spray-type deaerating heater. If conditions change, future sodium and hydrogen-zeolite softeners can easily be added.

New spray-type deaerator clears up major faults of old system, safeguards against oxygen pitting of boilers, keeps condensate-line maintenance to a minimum. And locating it some 35 feet above the boiler-feed-pump suction cured a severe cavitation headache.

MPC also gets substantial feedwater-temperature boost as a result of this new unit.



Ash handling . . . faster

Up-to-date pneumatic steam-jet vacuum ash-removal system replaces costly manual ash removal. Making good use of old equipment, engineers decided to slice off top 120 feet from the old stack, converting it to an ash silo. Silo roof now holds primary and secondary ash receivers, vent filters. Also, platform inside silo, 13 feet above grade, houses rotary dustless unloader—an important item in clean, fast ash removal at MPC. Sketch at left shows equipment arrangement.

Existing stub stacks were saved by simply adding 20-ft extensions to them. They now clear company sign keeping the sign free of stack-gas emission. Welded stiffeners on stack help support additional load.

PRINCIPAL NEW POWER-PLANT EQUIPMENT

Motor Products Corporation, Detroit, Mich.

Stokers, 2 ..... Detroit Stoker Co
Continuous cleaning grates, three rotors each, 40,000-lb-per-hr continuous evaporation, 127.5-ft active area

Deaerating heater, 1 ..... Cochrane Corp
120,000-lb-per-hr outlet capacity, 10-psig operating pressure, 20,000-lb storage capacity, atomizing deaerator

Coal-handling system ..... Fairfield Engineering Co
30 tons per hr, 1¼-in. bituminous screenings. Includes 12x12-ft track hopper, inclined apron feeder, centrifugal-discharge bucket elevator

Ash-handling system ..... United Conveyor Corp
10 tons per hr, automatic ash handling, steam-jet vacuum, pneumatic, primary and secondary separators, 25-tons-per-hr rotary dustless unloader

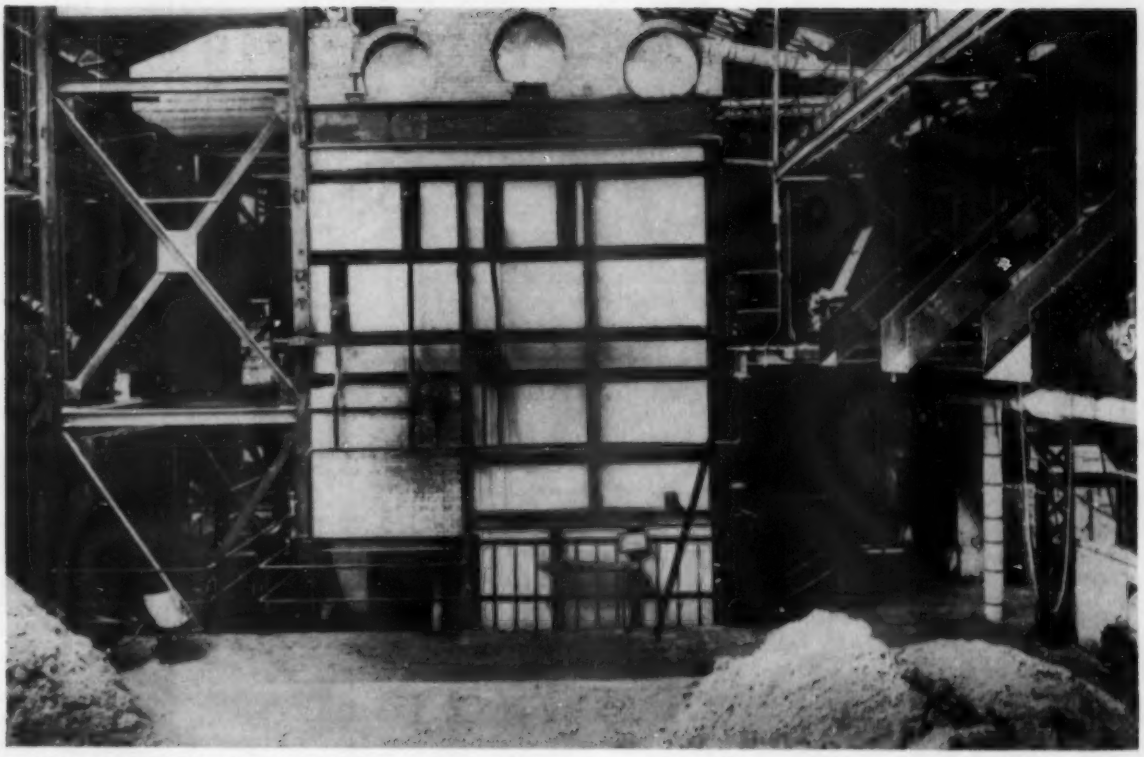
Overfire-air fan, 1 ..... North American Manufacturing Co
1750 cfm, 25-in.-wg static pressure, motor drive

Air compressor, 1 ..... Ingersoll-Rand Co
2950 cfm, 100-psig discharge press., 557 hp, compound, double acting, steam driven

Piping contractor ..... Stanley-Carter Co

General contractor ..... F H Martin Construction Co

Architects and engineers ..... Boddy, Benjamin & Woodhouse, Inc



RECONDITIONED BOILERS at sugar mill came from irrigation pumping plant seven miles from mill. Mounds in foreground are bagasse fuel. Conveyor brings fuel to refuse feeders shown to right of boiler. Feeder is designed so moist fuel won't jam

Mill burns residue with spreader stokers

Older boilers at sugar mill on island of Maui, Hawaii, gave poor bagasse firing efficiency, were hard to clean. So when time came for expansion, new units got modern firing equipment

By R H HUGHES, *Mill Department Head, Hawaiian Commercial & Sugar Co, Ltd*

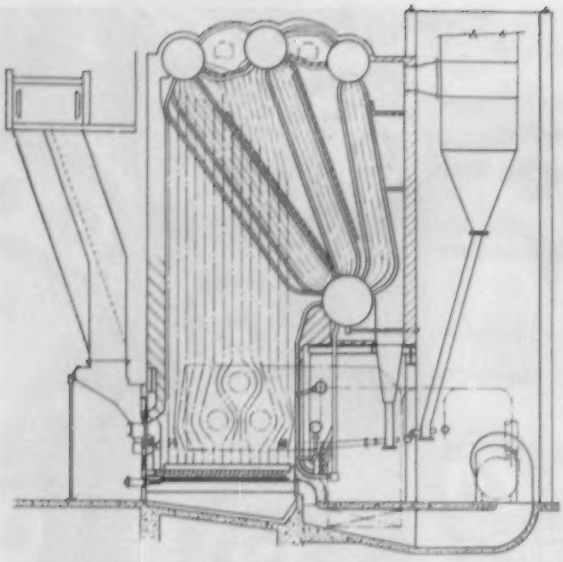
► OUR EXPANSION PROGRAM at the Puunene Mill, largest sugar factory in Hawaii, called for additional steam-generating capacity amounting to 100,000 lb per hr. Bagasse, residue from making cane sugar, was to be the primary fuel for the boilers furnishing this added steam.

Before expansion, all the boilers were fired with bagasse in step-grate furnaces with natural draft. Poor bagasse firing efficiency and furnace ash disposal difficulties dictated that we look for more modern firing methods for any new units at the cane-sugar-producing mill.

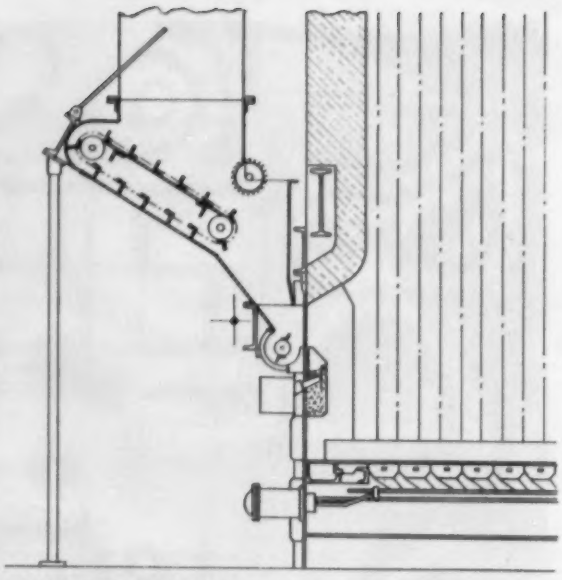
Decision to increase the mill capacity was made in 1951. And to get new boilers then meant extended delay in delivery because of the Korean conflict. Luckily the company had two 800-hp oil-fired Stirling boilers available. These units were at the recently electrified water pumping plant about seven miles from the mill. Inspection proved the boilers satisfactory for further use. So it was decided to go ahead on the basis of moving them to the cane-sugar mill.

Boilers. We contacted the manufacturer for a proposal for conversion of the units. Our needs were as follows: maximum continuous rating of 50,000 lb per hr per boiler operating at 150 psig, saturated steam; mechanical stoker equipment suitable for automatic combustion control for bagasse firing; mechanical removal of accumulated ash on grates.

The boiler manufacturers proposed removing certain generating tubes and



CROSS SECTION of Stirling boilers installed at mill. Note air jet under rotor and jets and cinder return in the bridgewall



FEEDER AND ROTOR insure regulated feed without jamming. This is the first refuse conveyor feeder installation ever made

installing waterwall tubes in three of the rebuilt furnace walls.

Firing equipment. The stokers proposed were spreader stokers with power dumping grates. Each boiler was to have three oil burners for periods when bagasse was not available. Additional major equipment proposed consisted of forced- and induced-draft fans as well as overfire air fans and a 40-ft stack.

The firing equipment had to be able to handle moist fuel without jamming. Cane residue at Puunene has a moisture content of 42%. (Heating value is 4730 Btu per lb as fired.) Cane is completely broken up by shredders in the milling operation before delivery to the boilers (see fuel photo at top, p 103).

Equipment picked to do the job consisted of four major elements: bagasse feeders; rotors; stoker air and overfire air; dumping grates.

The bagasse feeders are at the bottom of expanding hoppers, which hold the fuel supply. Feeders consist of a traveling flight conveyor, three feet long, and a feed roll above the discharge of the

How Stirling boilers were moved

TIPPING BOILER to horizontal position at recently electrified pumping plant

STRUCTURAL-STEEL CRIBBING built around each boiler made it possible to tip and lower the boilers into position to be received by 50-ton-capacity low-bed trailer

BAGASSE FUEL as it is received at the boilers. Fuel moisture content is 42%

conveyor. Feed roll is geared to the conveyor drive and rotates about three times the speed of the conveyor. This prevents jam-ups at this discharge point. (See illustration, top, right on facing page.)

Fuel, discharged from the feeder, falls through a chute to the rotor at the bottom of the chute. The 2-bladed rotor propels the bagasse into the furnace. Speed of the rotor may be varied to regulate the length of fuel throw and thereby the fuel distribution.

Bagasse is a low-density fuel and for this reason is difficult to spread by the rotor alone. So a series of air nozzles are located below the rotor to assist in injecting the fuel.

Air jets are in the watercooled bridgewall, one set just above the grates, another about halfway up the wall. Four cinder-return pipes are in between the two sets of air jets. (See illustration, top, left on facing page.) These nozzles in the target wall provide additional turbulence for suspension firing and also furnish needed combustion air.

Relocation, construction. Contract for supply of conversion materials was negotiated in April 1951. At the same time, we began to move the boilers from the pumping plant to the sugar mill (photos at bottom of this spread). By July 1952 the job was complete and the boilers were on the line.

Operation. The boilers have better than met our desired capacity, surpassing it by about 10%. They have operated continuously at 55,000 lb per hr each and at peak loads have run for an hour or more at 65,000 lb per hr.

Firing equipment has operated to our complete satisfaction. Original design conveyor feeder meters bagasse flow to the furnace under automatic control. The fuel burns largely in suspension. As a result, response to load changes is rapid, a very noticeable improvement over the response with our old step-grate furnaces. The new units will pick up from low to maximum loads in less than a minute when firing bagasse.

After about 18 months of continuous operation, no major outages have occurred because of modernized design of boilers or furnaces. Settings have remained in satisfactory condition during this time. Ash from the furnaces is very friable and easily handled, indicating furnace temperatures are well below the slagging temperature.

We dump the grates once every eight hours and hoe the ashes to an ash conveyor at the front. The conveyor sends the ashes to a bin from which they are taken once a shift to a disposal area. This is in sharp contrast to ash removal with the old step-grate furnaces. There we have to slice the ash from the grates, hoe it from the furnace, and take it by wheelbarrow to conveyors.

FIRING-EQUIPMENT SUMMARY:

Boilers ..... Babcock & Wilcox Co
Stirling, 180-psig design and 150-psig operating pressures. Boiler surface 7909 sq ft, waterwall surface 618 sq ft, furnace volume 3810 cu ft, steam-mechanical oil burners

Spreader stokers ..... Detroit Stoker Co
RotoStoker with power-operated dumping grates

Bagasse conveyor feeders .... Detroit Stoker Co

I-d fans ..... Prat-Daniel Corp

F-d fans ..... American Blower Corp

Overfire air fans ..... Buffalo Forge Co

Stack ..... Prat-Daniel Corp
40-ft Thermix stack

CARRYING BOILERS from pumping plant to sugar mill. On the way, each boiler was turned around on the trailer so they were in proper position for reinstallation

TRANSFERRING the boiler from low-bed trailer to temporary staging at the mill

Going to make a technical talk or present a paper?

Don't be a 'platform character'

Here are the steps that make it easy for you to . . .

Monotonous Morton . . .

has incredibly dull paper . . . reads every word . . . in monotone . . . doesn't look up . . . acts like he never saw his paper before

Get engineering ideas across to

► When you're presenting ideas to any audience, whether it's a group from your own plant, a meeting of the board of directors, or a session at a technical society meeting, you have to know how to get your thoughts across.

The steps outlined here will help any time you're addressing an audience. But we'll assume that you're going to present a technical paper. Let's see how to go about it.

Know why you're talking

Usually an engineer gives a talk or presents a paper because he's done something new and interesting, or because he knows more about some subject than his fellow engineers. He wants to pass along this information to his fellows—for their benefit and, of course, to increase his own professional standing and prestige. Such an exchange of information is basic to all engineering progress.

The key thought here is the *successful transmission* of ideas. No matter how valuable the work done, the whole thing falls flat unless the speaker succeeds in transferring his ideas and knowledge to the people in the audience.

If you fail to put across your ideas, not only have you wasted your time—more important, you've wasted the time of everybody who came to hear you. A speaker has a very real obligation to his listeners—they expect to be instructed, and perhaps amused, and have a legitimate complaint if he fails them. Too many speakers act as if the audience had no choice but to listen.

Keep the story simple

When you're presenting a technical paper, the first step is writing. (And that's usually the first step with any prepared talk.) The trouble is that engineers often assume writing a paper is the whole job, rather than the beginning only.

Let's take a look at this first step. Here, as well as in the spoken presentation, your job is to get your ideas across to someone else. So the prime need in any technical paper is clarity. And clarity, in turn, depends on simplicity.

Too many technical papers read as if the author is trying to impress people by using big words, complicated sentences and technical jargon. The trouble usually comes from the fact that the author is highly impressed by being asked to write a paper. He gets musclebound trying to express his thoughts in a dignified "scientific" style.

To help you avoid this, here are a few quick rules for clear, simple writing: (1) Use short words instead of long ones. (2) Keep your sentences short. Don't let them get long-winded. (3) Use specific statements rather than general. (4) Use active instead of passive verbs. Don't overwork "is," "was," and other parts of the verb "to be."

You can find out more from any one of several recent

Mike-shy Marvin . . .

stands three feet from the mike . . . weaves back and forth . . . either you can't hear him . . . or you get an ear-splitting boom

Screen-hog Sam . . .

uses slides showing silhouette of his head and ears . . . not much else . . . but no matter . . . you couldn't read the slides even if you could see them

an audience—short and sweet

good books—for example, "The Art of Readable Writing," by Rudolph Flesch, or "The Technique of Clear Writing," by Robert Gunning.

Choose how to present it

Now let's say you've done a good job of writing your paper. Next you must decide how to present it.

There are two apparent choices. First, you can read it. Second, you can give it extemporaneously. But the first is sure to kill interest and put the audience to sleep. You want your talk to transfer ideas and knowledge to your listeners. DON'T READ!

The second way—an extemporaneous speech—may be too difficult unless you are an experienced speaker.

Here's where you can take advantage of a $64 suggestion. It's not as good as extemporaneous speaking, but it comes pretty close and it's a lot easier for the occasional speaker.

Make up a 'speaking' version

Start by writing a "speaking" version of your paper. But, you say, I've written the paper—what's with this speaking version? How does it differ from the original paper?

Well, it differs in several major respects. In the first place, your speaking version should be much shorter than the written one. The paper necessarily includes all detail for a complete exposition of your subject. But, in speaking, your time will be limited by the schedule of the program.

More important, your time is limited by what the audience can take. Making your story too long and full of details defeats your purpose because you lose your audience. Remember the rule: The mind can't absorb what the fanny can't endure!

Always remember your audience

Your speaking version will also differ from the written paper in style. Communicating ideas by speech has some advantages—you can reinforce meanings by voice inflection, changes of pace, gestures, etc. But the listener has a handicap compared to the reader. If he misses a point, he can't go back and clear it up the way a reader can.

So clarity of expression rates top importance. Take particular pains to put your ideas in the simplest words and sentences and keep a sharp eye on the pace of the presentation. This doesn't mean the speed with which you speak, but the rate at which your ideas follow one another. Space them out with "filler" words and phrases.

Be particularly careful to use transition words and phrases that make the structure of your ideas clear and warn your audience of a change in subject or direction.

Finally, keep in mind that speaking is different from writing. Spoken English is loose, informal, colloquial. It uses slang, is lively and colorful. So in the "speak-

ing" version try to put down the words you'll give out before your audience. Leave some holes for extemporaneous comment, perhaps remarks on the lantern slides. Indicate spots where a story or a wise crack might liven things a bit.

Do your 'homework' beforehand

Now actually you're going to read this "speaking" version, but a little sleight of hand will kid your audience into thinking you're not.

First step is to put the speaking version on 3x5 cards. Then it will look like you are speaking from notes. Have the notes typed for easy reading.

Next, live with the cards for several days. Read them at odd moments, soak up the words and phrases, drill into your mind the order of the thoughts. But don't try to memorize!

If you do this conscientiously, you can use the cards as extended notes, speaking from them with only occasional glances. (And having the whole story at hand does wonders for your confidence.)

Then, since you wrote like you talk, and tucked in some side remarks and a story or two, you can put up a pretty good show, creating the illusion of extemporaneous talk.

Don't 'speak at'—'talk with'

The most important secret of effective speaking can be summed up in one sentence: "Never speak *at* an audience, talk *with* an audience." In other words, strive for a sense of communication. That's what makes good conversation interesting. And lack of it makes many a talk extremely dull.

Put yourself into the presentation. The ideas you're giving are yours—they're interesting and exciting to you. Don't act as if they are remote and impersonal. Let enthusiasm and conviction show as clearly as they would in a face-to-face conversation. Such natural animation and sincerity create the desired sense of communication.

Now one big caution: Take your time. You don't have to speak slowly, but it pays to pause between thoughts. This gives you a chance to refer to the notes to see that you're still on the track. Too many speakers are afraid of the pregnant pause. They either rush along or fill the gaps with unintelligible grunts.

Finally, speak clearly and loud enough so all can hear. If there is a mike, stay with it. Look at the audience. That way you can tell if they fall asleep.

Make sure you have the tools

The chairman of the meeting, if he's on his toes, will see that you have all the facilities you need to do a good job. But you must tell him what you need. And, since he may be green at the job, it's a good idea to check for yourself.

Is the rostrum in the right place? Can you refer to slides without standing in front of the screen? Is there a reading light so you can see your notes when the lights are out? Does it work? Is there a pointer handy? If you need a blackboard, is it in the right spot and equipped with chalk and an eraser?

For a good job, consider that you and the chairman are putting on a show. To keep it from being a flop, you must review every step of the presentation with him. Make sure you're both working from the same scenario and that you know your roles.

Slides—Watch out for booby traps

Good slides add tremendously to the interest and value of a presentation. Poor slides ruin it.

Technical societies have pamphlets on preparing and presenting papers. These include rules for size of lettering and other factors involved in making good slides. Study them and follow them. If you're not sure of the ability of your slide maker, take the precaution of looking at the slides, through a projector, before your talk.

Make sure the operator's thumbmark is in the right spot, and that the slides are in the right order. Then check with the operator before the meeting. Find out if the projector is properly set up and focused. Tell the operator how many slides you have, what order they're in, and about where they come in the talk. Don't leave anything to chance.

If you want to refer back to one or more of the slides after they have been shown once, tell him about it. Remember, he's working in the dark. He'll have a tough time finding slides 12 and 23 if you spring it on him without warning. Also check on the lights and arrange with the operator as to how they should be handled.

One more point. Try to make the slides an integral part of your talk. Don't put the listeners to sleep with a dull, slideless presentation and then try to wake them up at the end. You won't transmit ideas by rushing through 15 slides in quick succession when time is short. It takes time to absorb information.

Discussion—How to cope with it

When you've given the talk and it's gone off well, you are still not quite through. At most technical meetings there will be discussion. How this is handled depends to some extent on the rules of the society and the wishes of the chairman.

If you can take each comment as it's raised there is no particular problem, assuming you know what you're talking about. If the chairman wants to have all the discussion at once, to be answered in one closure, you have some work to do.

Make sure you have paper for taking notes and jot down the points and questions raised by each discusser. Get the discusser's name, too, so you won't have to say "In answer to the question raised by the bald-headed man in the third row."

When you get your chance for rebuttal, take up each comment in turn and dispose of it to the best of your ability. That's going to have to be extemporaneous speaking whether you like it or not.

Here's how you benefit

Suppose you've worked hard to learn how to get engineering ideas across to an audience. What good will it do you?

As a speaker, you'll get more deserved recognition for work you have done and knowledge you have gained. And if others get this speaking know-how, you'll find life in an audience a lot easier to take.

In addition, there's more to this than just presenting talks to technical societies. "Writing and talking are the most common engineering operations," says Phil Swain in his *Proverbs for Young Engineers*. "Other things being equal, skill with words will add between $20,000 and $100,000 to an engineer's lifetime earnings." So your work will pay off now and later.

Power's DATA SHEET

No. 274

A = Nominal pipe diameter, in.	B = Diatomaceous earth thickness (inner layer), in.	C = 85% magnesia thickness (outer layer), in.	D = Unit heat loss, Btu per hr per ft of pipe	E = Insulation-junction temperature, F	F = Outer-surface temperature, F
8	2	1½	479	553	162
	2	2	435	604	150
	2½	2	402	552	147
	2½	2½	374	588	140
	3	2	385	500	141
10	2	1½	576	562	164
	2	2	510	612	154
	2½	2	480	556	147
	2½	2½	434	598	140
	3	2	446	515	143
12	2	1½	596	521	157
	2	2	575	618	154
	2½	2	536	572	148
	2½	2½	498	606	144
	3	2	508	520	145
14	2	1½	710	572	166
	2½	2	579	573	149
	2½	2½	527	612	144
	3	2	542	528	145
	3	2½	503	567	138
16	2	1½	782	579	167
	2½	2	667	579	152
	2½	2½	580	620	145
	3	2	601	532	147
	3	2½	558	582	140
18	2	1½	837	597	155
	2½	2	706	576	152
	2½	2½	636	623	145
	3	2	660	537	147
	3	2½	601	581	140
20	2	1½	922	594	168
	2½	2	766	585	151
	2½	2½	700	623	146
	3	2	715	543	147
	3	2½	611	581	142

Economical high-temperature insulation

► MOST ECONOMICAL pipe-insulation thickness depends on: (1) unit heat loss (2) hours per year of operation (3) cost of heat (4) cost of insulation (5) amortization rate for insulation.

The table gives the unit heat loss for various-size pipes with different insulation-thickness combinations. These combinations consist of diatomaceous-earth inner layer and 85%-magnesia outer layer. The table is based on 1010-F fluid in the pipe and 85-F still air surrounding the pipe. This table can also be used for 1000-F fluid with no significant error.

Temperatures at the junction of the insulation layers and at the outer surface are also listed in the table.

Example: Find the economical insulation combination for a 12-in. nominal pipe carrying steam at 1010 F. Heat costs 40c per million Btu, the pipe will run for 8000 hr per yr. Applied insulation costs $7.25 per ft of pipe for the 2—1½ in. combination; $8.00 for 2—2 in.; $9.00 for 2½—2 in.; $10 for 2½—2½ in.; and $10.00 for 3—2 in. combination. Amortization rate for insulation is 10%.

The best thickness combination has the lowest total annual cost for heat and amortization. The following figures must be worked for each insulation combination to find the answer. Let's figure the 2½—2½ in. combination. This has a heat loss of 498 Btu per hr per ft according to the table. Then:

Annual heat cost = (8000 hr/yr) (498) ($0.4/$10^6$ Btu)
= $1.59 per ft of pipe

Amortization cost = ($10 per ft) (10/100)
= $1.00 per ft of pipe

Total annual cost = 1.59 + 1.00 = $2.59 per ft of pipe

This total happens to be the least so the 2½—2½ in. combination would be chosen.

H DEPAOLI — *West Reading, Pa.*

POWER pays $35 for each Data Sheet accepted. Why not submit yours today?

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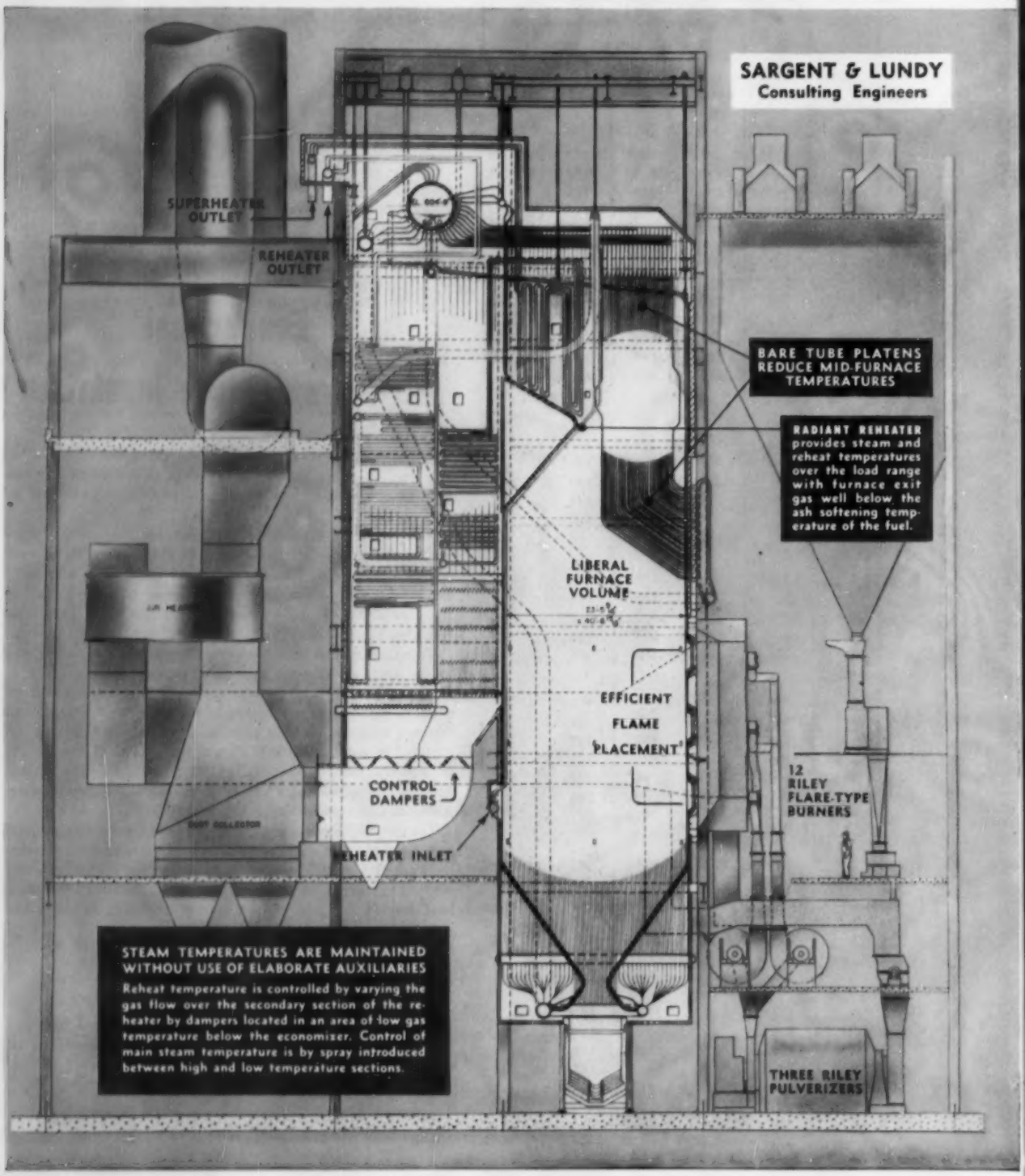
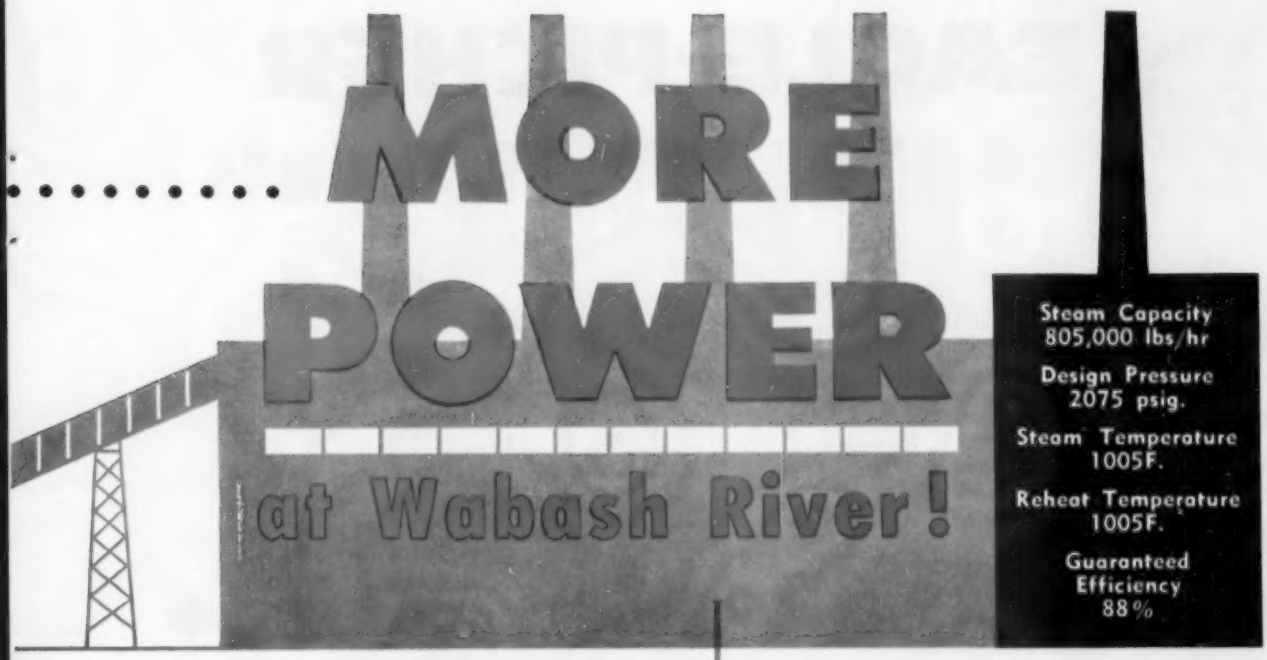
Public Service Company of Indiana, Inc.

selects this RILEY reheat unit for . . . .


SARGENT & LUNDY
Consulting Engineers
SUPERHEATER OUTLET
REHEATER OUTLET
BARE TUBE PLATENS REDUCE MID-FURNACE TEMPERATURES
RADIANT REHEATER provides steam and reheat temperatures over the load range with furnace exit gas well below the ash softening temperature of the fuel.
LIBERAL FURNACE VOLUME
EFFICIENT FLAME PLACEMENT
CONTROL DAMPERS
REHEATER INLET
12 RILEY FLARE-TYPE BURNERS
THREE RILEY PULVERIZERS
STEAM TEMPERATURES ARE MAINTAINED WITHOUT USE OF ELABORATE AUXILIARIES
Reheat temperature is controlled by varying the gas flow over the secondary section of the reheater by dampers located in an area of low gas temperature below the economizer. Control of main steam temperature is by spray introduced between high and low temperature sections.



Typical of the trend to more efficient and economical steam generating units is the Riley reheat unit recently purchased by Public Service Company of Indiana, Inc. This unit, the fifth and largest to be installed at the new Wabash River station is designed *specifically* to burn *successfully* poor grades of Indiana coal.

Design features that make this performance possible are: liberal furnace volume, adequate furnace cooling, bare tube platens to reduce mid-furnace temperatures, efficient flame placement, the use of radiant reheat surface and a combination of damper and spray steam temperature control.

The acceptance of Riley units by Public Service Company of Indiana, Inc. (this is its eighth Riley unit) . . . and by a steadily increasing number of other leading public utilities is due to design characteristics such as featured by this unit, high yearly net efficiency, dependability and continuity of operation.

For specific explanations and detailed descriptions of complete Riley steam generating unit designs write or call your nearest Riley Sales Engineer.

Public Service Co. of Indiana, Inc. is one of many important public utilities that in recent years have ordered Riley Reheat Units . . .

Utah Power & Light Company
Gadsby Station
1-575,000 lbs/hr; 1700 psig; 1000/1000F.

Louisiana Power & Light Company
Nine Mile Point Station
1-1,000,000 lbs/hr; 1725 psig; 1005/1005F.

City of Los Angeles, Dept. of Water & Power, Valley Steam Plant
2-1,200,000 lbs/hr; 2075 psig; 1000/1000F.

Houston Lighting & Power Company
Deepwater Station and Sam Berton Steam-Electric Station each
1-1,200,000 lbs/hr; 2125 psig; 1005/1005F.

Texas Electric Service Co.
Fort Worth
1-1,250,000 lbs/hr; 2125 psig; 1005/1005F.

Central Louisiana Electric Company, Inc.
Teche Station
1-350,000 lbs/hr; 1050 psig; 1005/1005F.

Florida Power Corp.
Suwannee River Plant
1-600,000 lbs/hr; 1550 psig, 1000F/1000F.

Dairyland Power Cooperative
Alma, Wisconsin
1-390,000 lbs/hr; 1650 psig; 1005/1005F.

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

Complete Steam Generating Units and Fuel Burning Equipment for Public Utility and Industrial Power and Heating Plants

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Stoker Corporation
WORCESTER, MASSACHUSETTS

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BECAUSE IT STICKS, *it saves time*! Eagle-Picher Super "66" *really sticks*, makes difficult jobs easy, usually requires no reinforcing on applications up to 1½ inches thick. It applies quickly to any equipment, cold or heated up to 1800 F.

BECAUSE IT STICKS, *it saves money*! Low-cost Super "66" provides far greater coverage and more effective insulation. Its "springy ball" structure of small, resilient pellets of mineral wool, with thousands of dead air cells, assures maximum fuel savings!

BECAUSE IT STICKS, Eagle-Picher Super "66" can be used on irregular shapes where application of other insulations is often impossible.

PREVENTS RUST, TOO! Super "66" contains a special rust inhibitive that actually prevents corrosion.

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Prove to yourself how easy it is to apply Super "66" wherever insulation is needed!

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EAGLE EP PICHER

THE EAGLE-PICHER COMPANY

Producing a complete line of industrial insulations

Cincinnati 1, Ohio

(Member of Industrial Mineral Fiber Institute)

(Conforms to Commercial Standard CS117)

Bob Gad Jr, office-planning division of Shaw-Walker Company, explains . . .

Office layout for engineers

► YOUR OFFICE is your base of operation and must be laid out just as carefully as your power services, your maintenance shops, or your production lines. Whether you have a one-man setup or a large staff, proper equipment and layout help you do a better job.

Plant and power engineers having large staffs often know what's wrong with their office from a personnel angle, but usually can't do anything about it. One reason is that when you work with a man day after day, it's pretty hard to deprive him of an office or move him away from his favorite window. You know that moving him would make the office run smoother, but it often takes an outside expert to make these changes. His advice is accepted on an impersonal basis, so changes that he makes cause little friction, if any.

Large sums of money are wasted on needless office construction, on renting inefficient space and on personnel and equipment in hit-or-miss planned offices. Here are seven typical engineers' office layouts with my reasons for planning them so. You can profit from putting this information to work in your plant.

Turn page for typical layouts

1: One-man office

Office space for a one-man power-engineering department is extremely flexible. It should be based on the job demands of your plant. Counter, with files underneath, is for an engineer who occasionally requires layout space. This can be made a storage wall if layout space isn't needed.

Provision is made here for you to do your own instrument reading, record keeping and filing. An extra table for small layouts, and enough chairs and space for holding small meetings have also been provided. As a power engineer, your office must be placed as close to the areas of frequent contact as possible to keep travel to a minimum.

2: Space for three

A power engineer, his assistant, and a secretary occupy this convenient office. The presence of a light table and the large plan file indicate frequent reference is made to plans. Tracings can be made with minimum delay.

General table adjacent to the files is handy for studying plans and using other file material. Also for holding small conferences. Usually an office of this nature either opens into or is very close to the principal shop or work area. This layout provides additional privacy; also, a reception area when your plant-engineering department gets busy on purchasing. Partitions for the two enclosures are 5 ft 9 in. high, glass-topped "bank screen," allowing for distribution of light and air, which is important.

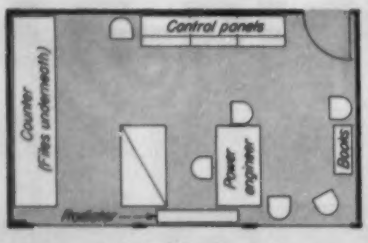
3: Need privacy?

This arrangement presents a roomier appearance than ceiling-high partitions would. Layout along rim of building allows all four occupants to have access to windows. It also places them closer to the shop and corridor leading to other office functions they contact often.

4: Maintenance office

This office shows how to put all possible people on the rim of the building, while using inside wall space for bulk equipment and storage. Because of the field engineering functions carried on out of this plant-engineering office, there's space for drafting tables and a vented blueprint machine.

Cutting and wrapping table is provided so reworked drawings and prints can be sent to the home office or central files. Complete plant maintenance as well as design modification and interpretation of shop work could be conducted from an office like this.



1: Flexible layout

5: Privacy and space

Layout of this plant-superintendent or plant-engineering office finds the drafting tables located to take advantage of available natural light over the left shoulder. All personnel are on aisle space to avoid interrupting each other, all facing in same direction. Bank-screen partitioning provides enough privacy for the superintendent, yet eliminates need for special air conditioning.

General files open into each other to eliminate the hazard of drawers opening into a busy aisle. General tables are available for discussing blueprints with shop foremen—also for other office functions. Because location of a column is considered in this layout, little space is lost from this obstruction.

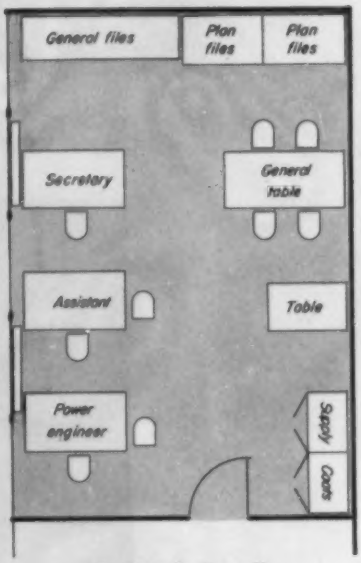
6: Large 15-man space

This 15-man office accommodates the functions of both plant engineer and plant superintendent, together with their staffs and files. There's good access to files, and all workers but the plant engineer's secretary face the same direction. Secretary, who faces the door rather than a wall, can serve as receptionist for the area. Private offices are each 10x12 feet, but are equipped with different furnishings.

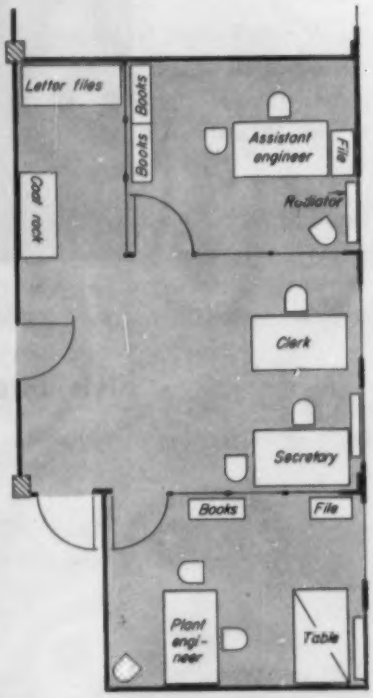
Plant engineer has a conference-top desk, while the superintendent has an extra table and individual files. Both offices have bank-screen partitions for proper light and air distribution. Conference table eliminates the need for larger private offices or for a conference room that is seldom used. Shop personnel may also use this table for making out reports, estimates, records, etc.

7: Space for 27 persons

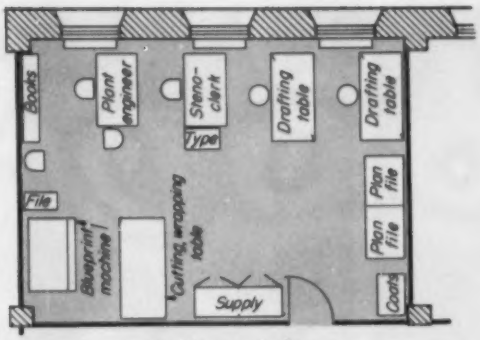
This office provides for 27 persons, including expansion room for two more employes in the present layout. Central files are provided because of their number and the frequent reference to them. Reproduction and photostat room and files are both accessible to the shop without travel through the rest of the office.



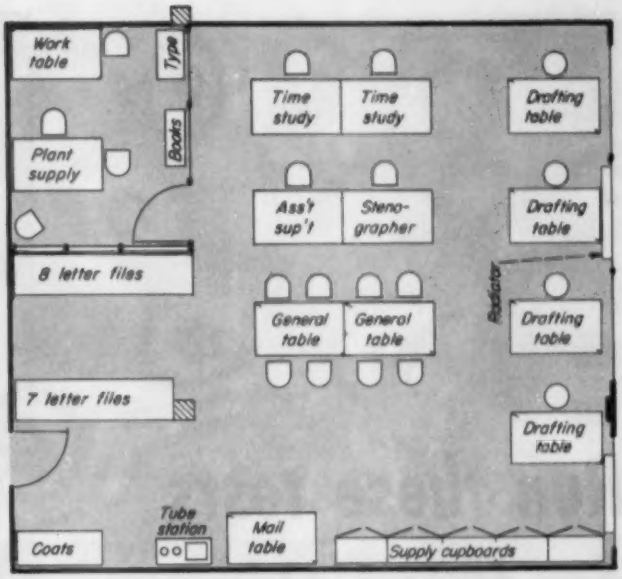
2: Handy for all



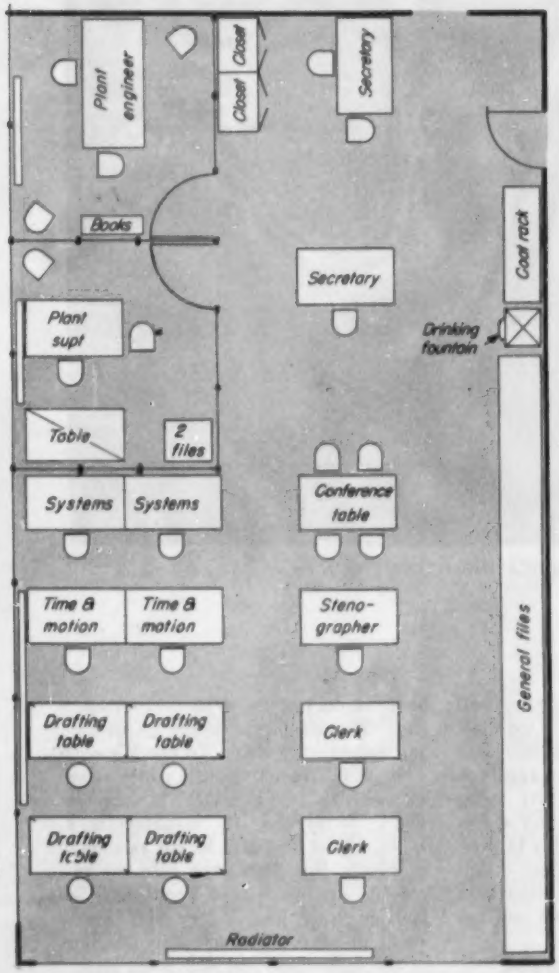
3: Plenty of space



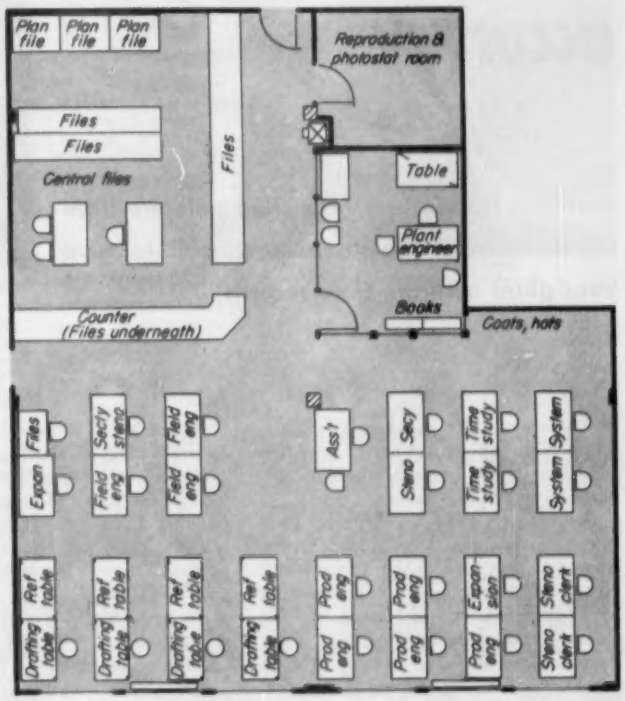
4: Near windows



5: Personnel on aisles



6: Good access to files



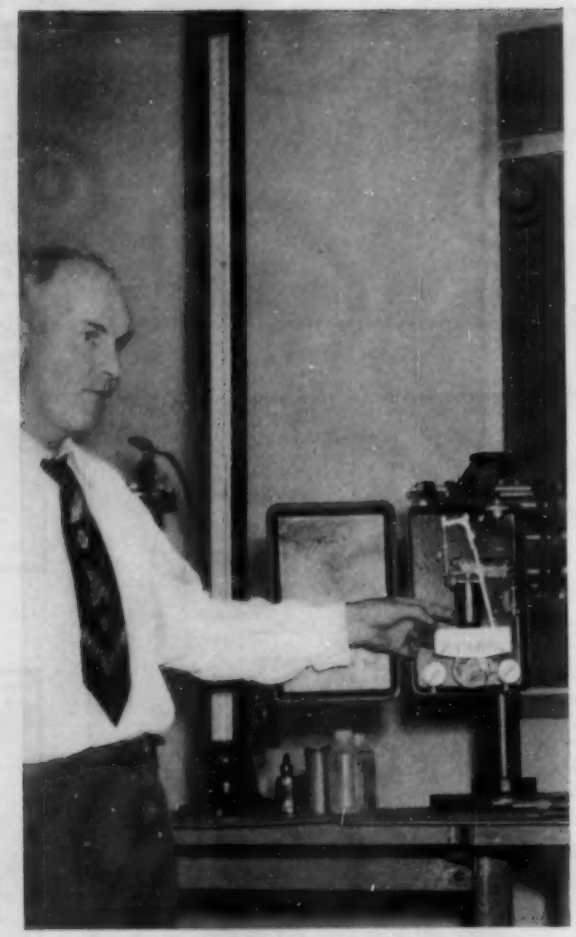
7: Columns are not in way

Plant engineer's office has bank-screen partitioning, while the reproduction room has ceiling-high partitions for light protection and for venting. Coat rack is in the open for good visual control and for ventilation of damp coats.

Drafting tables have reference tables adjoining for spread of material. Width of aisles and corridors should be determined by the amount of traffic. It's generally best to locate as many people directly on aisles as possible. In this case only four employes have to pass behind someone to reach the aisle. Column positions have been taken into consideration so no personnel space is sacrificed. There's also little or no interference with traffic in this office.

Run these tests for flowmeter accuracy

Here are testing and inspection pointers from the Instrument Maintenance Clinic* to give your plant accurate flow records



INDICATING FLOWMETER is explained by Bill Kehoe

► FOLLOWING UP January's maintenance clinic on control valves (pp 109-111), we'll now cover sessions on mechanical orifice-flowmeters.

Sources of error. If you've good reason to suspect flow-reading errors, first place to check is the orifice itself. Here's what to look for: (1) Rounding off (due to erosion) of leading edge on orifice plate gives low reading. Flow becomes less turbulent causing drop in pressure differential across the orifice. (2) Accumulation of dirt on upstream edge of orifice will also cause your meter to read low. (3) Dirt or other foreign material in pipe, ahead of orifice, results in low readings. (4) When dirt partly obstructs hole in orifice plate, higher pressure differential boosts flow readings above true value. (5) Chemical deposits in pipe give low readings at first, but when orifice-plate hole itself becomes clogged, readings are too high.

Lines from orifice to meter body can also be the cause of incorrect readings. Sagging lines, especially where meter is above pipe, will trap mercury at low points. Trapped mercury adds to pressure differential across orifice, makes meter read high. If you're faced with this problem, keep runs short and use additional supports.

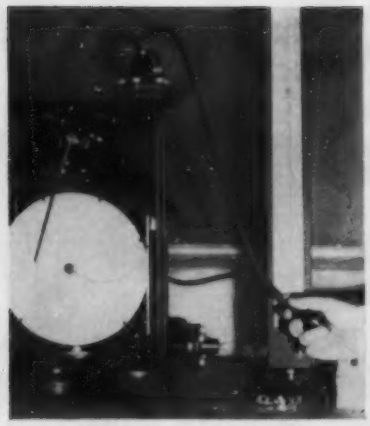
Checking differential. Swinging over to the meter body and the indicating or recording instrument itself, we'll check meter differential. Meter must be taken out of service first. On most meters this simply means shutting needle-type meter valves in lines connecting instrument with orifice, and opening an equalizing valve between upstream and downstream sides of the meter body.

Hooking rubber tubing from water column to meter-body test connection we compare differential meter readings, photo facing page, to water-column readings. Manufacturers supply tables listing comparative data. To check meter over its full range, throttle meter valve on upstream side of orifice. If readings don't correspond to manufacturer's table, adjust float-arm length as shown in photo. But first make sure the recording pen reads zero when meter is isolated from line. There may be a small difference between zero position of the differential-pen arm when meter is under pressure and when it isn't. Check the pen arm under working pressure conditions and make a permanent record of this difference. Then hold it constant throughout tests.

If the pen arm appears sluggish, pen may be bearing too firmly on the chart. When this happens, carefully bend the pen arm outward until pen point just makes contact with chart.

Test float's zero position when differential pen rests at zero to make sure

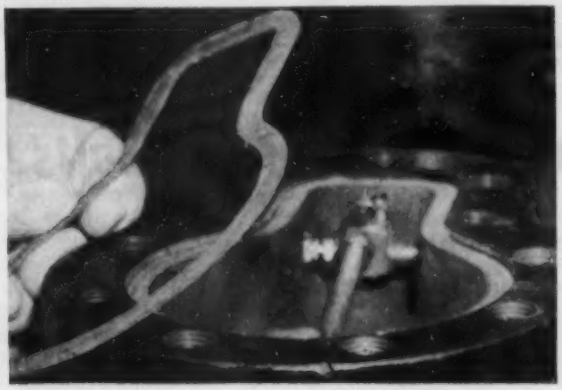
*Based on lectures by Bill Kehoe of American Meter Co at 5th Maintenance Clinic sponsored by the Instrument Society of America.



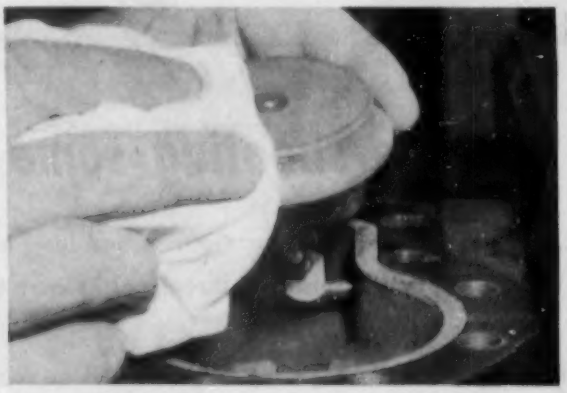
CALIBRATING flowmeter by comparing recorder-pen readings with water column

ADJUSTING float-arm linkage in float chamber to eliminate any reading errors

ZEROING recorder pen at start of calibration test is an important first step



GASKET condition is an important factor in keeping flowmeters leak free. Soap-water solution makes good leak tester



CLEANING float and float chamber thoroughly should be part of regular maintenance. Also, check the mercury condition

it's floating, not resting at bottom of the mercury chamber. Insert a small rod in the low-pressure chamber and touch the float. If you can depress the float, it's not resting on bottom.

Calibration check of pressure elements—helical or bellows springs—should be made throughout their range. First, make sure spring's pressure range is same as listed on recorder chart. For best spring-testing results, use an inspector's test gage—one that's been checked against a dead-weight tester. If you're checking a low-range spring, test gage should first be calibrated with a mercury column.

You can make good over-all check for the installation by attaching a U gage to additional taps in main line at same distance from the orifice as meter taps. If your meter readings and test-gage readings are the same, chances are there aren't any leaks or dirt accumulations giving you a false differential. See that gage-line tap connections don't project into the line.

Central flow. Simple way to find out whether line flow is central with the pipe and orifice is to install sample pressure taps, in the line or orifice flanges, 180 degrees from taps that are connected to the meter. Connect U gage between meter tap and sample tap. Since both taps are same distance from the orifice, no differential should show up on the U gage. If you're getting a differential reading, flow isn't central, or there may be dirt in the U-gage connections.

Micrometer will come in handy when you check orifice plates. Measure orifice-plate diameters as well as pipe inside diameter. If you're using heavy or extra-heavy pipe, and orifice coefficients are based on standard pipe, readings will, naturally, be off. For large orifices, the coefficient difference may be several percent.

Mercury in meter body can last as long as several years depending on whether operating conditions tend to contaminate it. Surface of clean mercury is shiny and has convex shape due to surface-tension effect. Dirt in mercury breaks down surface tension, giving surface a slightly concave shape. When this happens, strain mercury through a clean cloth. If it's still dull, replace it.

Blow down connecting piping regularly and you'll lick many headaches before they start. Don't forget to close valves to meter and open equalizing valve before blowing down. Also, after blowing steam meters, allow enough time for connecting lines to fill with condensate. Then open meter valves.

One last pointer: Don't expect accuracy from a meter that isn't clean. Include cleaning float chamber and float, photo above, as part of your regular maintenance and service schedule.

Trouble-shooting some diesel operating faults

C T Baker of Atlanta, Ga. has had long experience tracking down what ails faulty plants. Here are three cases where the operator should have known better

► MOST DIESEL and gas-engine troubles I've run into could be traced to poor operation—few could be blamed on equipment faults. Let's take a look at three cases that show what poor operation can do to an engine or a plant.

Case No. 1. I call this one The Case of the Neglected Water System. It occurred in an ice plant fitted with a diesel-driven compressor that ran round the clock for about eight months of the year. When first installed, the engine performed well, being economical in its fuel and lube-oil use, and requiring only routine maintenance.

Besides looking after the diesel, the plant operator had a number of other duties in the building. These kept him on the run so much that several hours might pass while he was out of the engine room. During this time the engine wouldn't be checked at all.

Though the engine was well-equipped with thermometers for jacket-water inlet and outlet temperatures, exhaust pyrometers, and water - temperature alarms, most of these were eventually broken or allowed to get out of whack. Neither the plant operator nor the utility man had enough time or interest to properly care for the engine and its instruments.

So when the jacket-water circulating pump failed one hot August afternoon, the pistons seized and the engine stopped without warning of any kind. The seizure was so bad that an electric motor had to be installed while the crew tried to repair the engine.

Engine-repair costs proved so high the unit was scrapped. Poor operation and not enough control maintenance killed this engine.

Case No. 2. Known as The Case of the Noisy Gas Engine, this is a good example of what sloppy thinking can do. A 200-hp gas engine ran sweet and "purty" for two years, then suddenly developed such a loud exhaust noise in one cylinder that occupants of other buildings in the area began to complain. Power output fell markedly.

While the operator was looking for the cause of the noise, one crack developed near the cylinder-head bolt circle, another opposite it in the liner. Engine had to be shut down.

Tracking down the trouble showed the wrong high-tension magneto had been installed on the cylinder during an overhaul. This threw out the timing, leading to the cracked head and liner.

Case No. 3. This concerns cheap fuel oil—purchased by the plant owner who was a business man, not an engineer. A long-distance call from a fuel dealer to the plant owner led to purchase, sight unseen and performance untested, of a large supply of fuel oil at low cost.

When the fuel arrived and was piped to the engine, the unit began to hunt badly. Inspection of the fuel-oil strainers showed they were almost completely plugged with sand and grit. In a few days a fuel line to one of the cylinders burst, causing a serious fire and requiring another shutdown.

Poor operation, sloppy maintenance and cheap fuel—three faults that lead to trouble. Try to avoid them in your plant. How? Here are some pointers.

Where possible, assign only engine-room duties to an operator. Work done outside the engine room, while often possible, is usually not too good an idea unless the engine is extremely small and is completely protected by automatic controls and alarms. With large engines, keep one man on duty whenever the unit runs.

To reduce errors during maintenance, set up definite step-by-step procedures. Plenty of companies with a large number of engines scattered through several plants have done this successfully.

STEAM

Top performance from your heat exchangers with backwashing

By J D CONSTANCE
Professional Engineer

► As little as ⅛ inch of sludge or scale can reduce heat transfer by as much as 15%. Fig. 1 shows graphically what happens when a cooler gets fouled. Area bounded by temperature lines t_1t_2 and t_3t_4 in 1a represents operation with reasonably clean surfaces. Dashed lines $t_2t'_1$ and $t_3t'_4$, on the other hand, show what happens to temperatures when scaling occurs. Thus, the operator sees the leaving-fluid temperature go up and the leaving-coolant temperature go down with scaling.

Backwashing helps keep the heat exchanger's efficiency up where it should be. Fig. 2 shows a possible setup for backwashing when the unit discharges to the sewer or a sump at atmospheric pressure. The bypass arrangement is such that valves 2 and 3 are open during normal operation, 1 and 4 closed. This is just reversed for backwashing. Three-way valves in place of valve pairs 1-2 and 3-4 insure proper operation. Thermometers give operator constant check as to when unit should be backwashed.

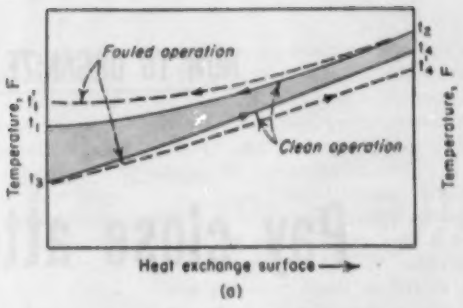
Fig. 3 shows how cooling-tower heat-exchanger arrangement can be rigged for backwashing when there is sufficient head from tower to exchanger. If normal flow from the tower to the exchangers is cut off, water remaining in the heat-exchanger discharge line to the tower still exerts pressure depending on the difference in height of the exchanger and the inlet to the cooling tower.

Valves 2, 4, 7 and 8 stay closed during normal operation, as do the compressed-air-supply valves. To backwash the left-hand exchanger after normal flow is stopped, open valve 2 and the left-hand compressed-air-supply valve, close valves 1 and 6. This allows water in exchanger discharge line to back up through the exchanger.

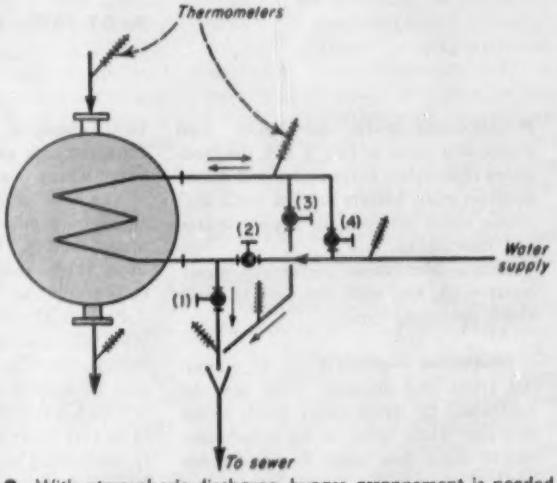
This sudden reversal of flow breaks down some of the sludge and soft scale. Turbid water is dumped to the sewer. When returning to normal flow, this second reversal dislodges more sludge. A second drain connection at the exchange discharge sends this additional sludge to the sewer instead of the cooling tower.

Close observance of the temperature of the fluid leaving the unit tells the operator when backwashing is needed. When he sees a decided rise in temperature, it is time to backwash. If the procedure is doing an effective job, operator can see sludge and scale carried to the sewer by the backwash water. And when the unit is back in normal operation, temperature of the cooled water should be almost as low as for clean tube operation after overhaul.

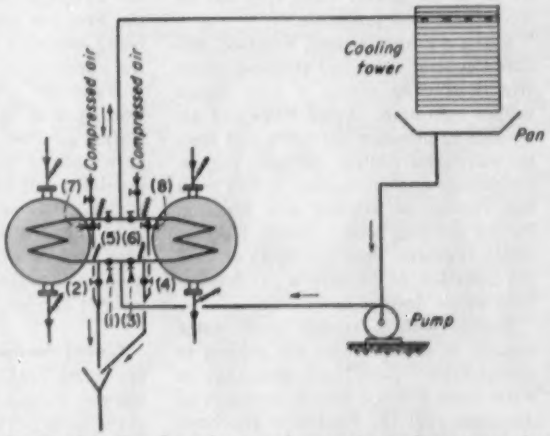
The compressed air increases the turbulence of the backwashing water. This helps to dislodge more sludge and scale. Past experience has shown that you get a more efficient job with the air than without.



1 Clean operation of this cooler is illustrated by the solid lines in graph. Dashed lines are for fouled operation



2 With atmospheric discharge, bypass arrangement is needed for backwashing. Thermometers give efficiency check



3 Head in line from heat exchanger to cooling tower gives pressure for backwashing. Turbid water goes to the sewer

Pay close attention to feedwater regulators, heaters, evaporators

These important units control the water level in your boiler, increase its over-all efficiency, remove oxygen and carbon dioxide, and provide pure water for makeup

By D C SWIFT, *Ebasco Services Incorporated*

► COMBINED WITH the boiler feed pump, discussed in Feb, p 104, the feedwater regulators, evaporators and closed or deaerating heaters are the units that act on water between the supply source and your boiler.

Here's how these important auxiliaries work, and what you need to know about operating them.

Feedwater regulators are of numerous types and designs. They may be controlled by drum-water level, steam flow and water level, or by a combination of steam flow, water flow and water level. They can be direct-operated, remote-motor-operated or pilot-operated by air or oil power. Each type has its advantages and problems.

Using a properly sized, V-ported, balanced control valve and avoiding excessive head drop across it help secure proper operation. Avoid leaks and air pockets in pressure chambers and lines for successful control. Be sure regulator linkage and mechanism is free from lost motion or friction and binding. Before starting boiler, check level at which regulator float chambers or pots are installed, to be sure water level is held within desired limits.

Boilers with relatively small water storage in steam drums are subject to considerable "swell" and shrinkage in water level if steam output increases or decreases rapidly. Feedwater regulator can do little about compensating for these changes. Best precaution is to limit the rate of load change to a safe value where possible.

You need shutoff and bypass valves so regulator repairs and inspections can be made readily. Operating controls for these valves should be handy for quick emergency use.

Periodically check tightness of regulator valve's shutoff. Under certain conditions, valve body, stem, disk and seat may be subject to heavy erosion.

Check water level and flow constantly to be sure feedwater regulator is properly controlling this important element of boiler operation. Frequent use of hand control keeps operators familiar with the technique of hand regulation. For the first few weeks when the boiler is being started, it is well to use hand control entirely.

Watch the regulators closely at low loads, particularly when boiler is being started up from cold, as level pots may have become empty or airbound, and regulator will not hold proper level for a time. Pots or thermostats may need to be shielded from rain or sun on outdoor boilers where action of the elements can cause a rather severe change in level carried.

Closed feedwater heaters generally use steam bled or exhausted from turbines or engines to heat feedwater going to the boiler. The water may make one or more passes through the heater. To take advantage of superheat in heater steam, special sections or baffles are sometimes used. Outlet-water temperature can then be raised above saturation temperature corresponding to steam pressure. Other heaters have special arrangements for cooling condensed steam below saturation temperature by passing cool incoming water through tubes submerged in the condensate.

For proper heat transfer, you need clean surfaces, an air vent from the steam side, and heater drainage to the proper level. If venting is insufficient or if air-deflecting baffles are improperly placed, part of the heater surface is ineffective.

If incoming steam contains oil, tube surfaces may gradually be coated until heat transfer is poor. Similarly, scale or other deposits may accumulate on the water side of tubes.

Most convenient way to measure heater efficiency is to observe the terminal difference between saturated-steam temperature and temperature of feedwater leaving the heater. For a given flow, steam pressure and entering feedwater temperature, the leaving temperature should remain the same.

Check heater performance as early as possible to compare with the manufacturer's guarantees, and also to furnish a standard for checking future performance.

To cut into service, warm heater gradually to avoid unequal expansion and

resultant leakage, particularly if there are high-pressure heavy-bolted flanges. Water should be flowing through the tubes with heater bypass valve closed before turning steam into the heater. Open vents wide for a short time, then close off except for intermittent opening if the steam contains little air. Where steam is under a vacuum, more air leakage is likely and vents are usually left cracked open. The drainer valve or pump should remove heater drip steadily and completely so all steam-condensing tubes are clear of water and exposed to steam.

Tighten up the bolts several times the first day or two of service at normal temperatures to establish normal bolt tension at operating temperatures. If a leak appears, tighten bolts to a reasonable extent, but if leak does not stop, renew the gasket promptly to prevent cutting the seating surfaces.

Leaks in tube rolls may result from poor or excessive rolling, or excessive temperature changes with inadequate provision for tube expansion. This leakage usually shows up in higher-than-normal levels in drainer sight glasses. Reroll leaking tubes promptly, or remove the tube and plug the hole. Continuing leakage along the tube cuts the tube sheet, making for a difficult repair job. Eventually you may have to replace the entire tube sheet or tube bundle.

Drip pots that are too small in diameter may cause violent fluctuations in water level and hunting of regulating or drain valves. Top of drip pot must be vented back to the heater through a line that has no pockets or traps.

Indicating thermometers or test wells should be provided at inlet and outlet of each heater condensate line, on drip line and on steam line to heater. Provide pressure gages or test connections at heater inlet, and on water lines to and from the heater. Using these test points for regular hourly readings and for occasional checks of heater performance helps assure best plant economy.

Deaerating heater, especially the tray type, should be set firm and level for even water distribution over the deaerating trays. In the spray type, this is not quite so important. Trays are often monel, stainless steel or a similar metal to resist corrosion.

Unit usually has a vent condenser for best operation. Cool incoming water passes through the inside of the vent condenser tubes, thus condensing the steam. This permits removing a large amount of the steam-air mixture while saving most of the heat. Only noncondensable gases are wasted to atmosphere. The drain from the vent condenser should be carried down several feet and sealed at its bottom to avoid vapor flowing back up the drain and consequently flooding the tubes.

If water is very cold or if a large quantity passes through the vent condenser tubes, a partial low-pressure condition may occur intermittently, causing water to be carried out the vent. Check heat pickup in this unit occasionally to insure maintaining adequate venting and condensing action.

Vent condenser tubes should be noncorrosive metal to resist the action of carbon dioxide and oxygen usually present in concentrated quantities.

If tubes leak, unit may partially flood, thus interfering with venting.

Steam for deaeration is usually brought into one side of the deaerating trays or is blown counterflow to water in the spray-type unit. If you are using evaporator vapor or other steam containing much oxygen or carbon dioxide for heating and deaerating, bring it in near the top or near the outlet to the vent condenser. Then, if you also use cleaner steam, possibly bled from a turbine, it has a final chance to scrub the deaerated water clean.

Safety valves should have capacity adequate to prevent pressure build-up beyond allowable limits when relieving all the steam that can enter the deaerating heater. Set valves to design values and try them out periodically.

Overflows should be automatically operated, and arranged so deaerator cannot drain completely even if the valve sticks open. Blowdown valve and line should be large enough to carry off normal amount of water entering the unit. When first starting up, make a trial at partial opening of the line to check against undue hammering or vibration when water overflows. Then open overflow wide for automatic operation.

Be sure to clean deaerator trays and storage compartment of all debris before putting in operation. Check that there is a collar at water outlet on bottom of storage compartment to prevent debris and dirt that may enter later from getting into the feed pump suction.

The heater storage tank should be set well above the pump, particularly if it supplies a boiler feed pump. This provides ample head at the pump, prevents flashing or cavitation and possible pressure loss.

It is especially important if steam supply to the unit is from an unregulated bleed point of a turbine, as a sudden loss of turbine load drops steam pressure to the deaerator, causing water to flash. With severe flashing extending far enough down toward the pump suction you may lose pump prime. Pump damage and possible failure of water supply for the boiler result.

In some installations, regulating valves hold a steady steam pressure on the deaerator, or steam from a higher-pressure source may be admitted to keep pressure above a certain point.

In other installations, a small-area semiopen passage in the deaerator permits cool water coming into the storage tank to pass directly to the pump with little or no mixing with hot-water storage. Thus any steam bubbles that might otherwise reach the pump are quenched.

Check storage-tank gage glasses and high- and low-water alarms for desired elevation, freedom from friction and operating sureness before using.

Evaporators generally supply pure water for boiler makeup in plants that have only a small makeup requirement, usually 3% or less. The evaporator consists of a pressure shell to hold the water and a steam coil that is submerged below water level. When steam is turned into the coil, the water boils and the pure steam produced passes out through a separator or purifier. Then it goes to the deaerator or high-heat-level condenser where it condenses and the heat is absorbed in the boiler feedwater.

Evaporator feedwater may be softened with zeolite to avoid depositing scale on the evaporator coil surfaces. But most evaporators are arranged for turning cold water onto the hot coil suddenly, or for turning steam rapidly on the coil when it is submerged. Expansion and contraction of the coils crack off the scale, which is then removed through the evaporator blowdown.

Using softened water prevents scale accumulation with the gradual capacity reduction that accompanies it. But the softened water maintains all the solids dissolved in it so the shell water concentration builds up more rapidly and is more alkaline. Then unless you use continuous blowdown, or drain or blowdown often, the evaporator may prime or foam, carrying part of the shell impurities into the boiler-water circuit.

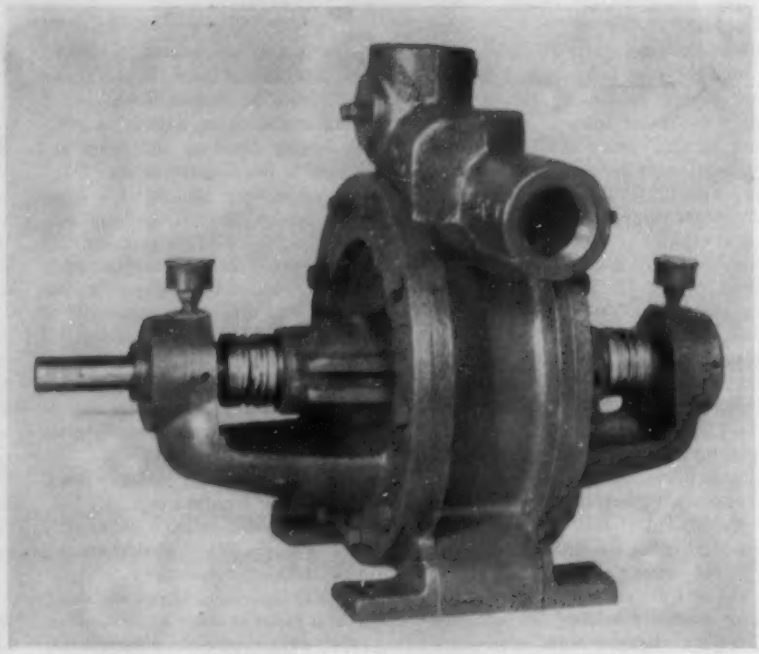
Evaporator makeup is usually passed through a deaerating heater to remove oxygen and free the carbon dioxide. Otherwise, these elements would be carried out of the evaporator with the vapor, or might corrode the evaporator or associated equipment.

(*Continued on page* 222)

FIRST OF TWO ARTICLES

By

E L ABRAMSON, *Chief Engineer*
Turbine Pump Department
Aurora Pump Division
New York Air Brake Company



1 **TWO-STAGE** turbine pump with single outside-type mechanical seals is designed for handling hot condensate against pressure differentials of 125 to 150 psi

Steep head-capacity and the most favorable suction-lift characteristics make this pump well suited for many power and industrial jobs. Get quick facts on . . .

The modern turbine pump—choice of

► TURBINE PUMPS develop pressure by impulsion, but centrifugal force also plays a part. This type is known by many names, including peripheral, regenerative, impulse, turbulence and rotary, but turbine* is preferred. The pump inventor chose this name because the impeller looks like that of a steam turbine, Fig. 2.

The two general types of turbine pumps have impellers of radial-vane design, Fig. 2, and inclined-vane design, Fig. 4. Radial-vane impeller is more generally used because it costs less to build and has comparable efficiency for the same operating conditions.

There are many casing differences. Two common ones are peripheral inlet and outlet designs, and end inlet with peripheral outlet. Each has features desirable either in manufacturing or in application. First type permits opening the pump without disturbing its piping.

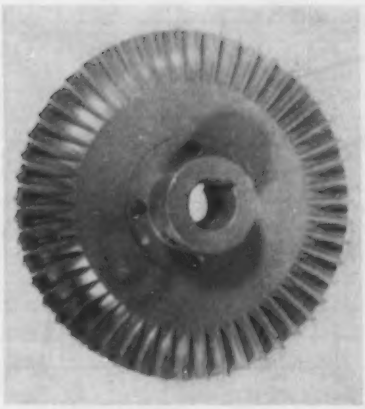
Other differences include multistage pumps, vertical units, water-jacketed stuffing boxes, close-coupled units and self-priming types.

Liquid flow. Though turbine pumps are included under the general classification of centrifugals, their flow pattern is entirely different and the forces at work are not the same. In a centrifugal pump, liquid enters the impeller at its center and is thrown outward into a suitably shaped channel. From this channel it flows to the pump outlet.

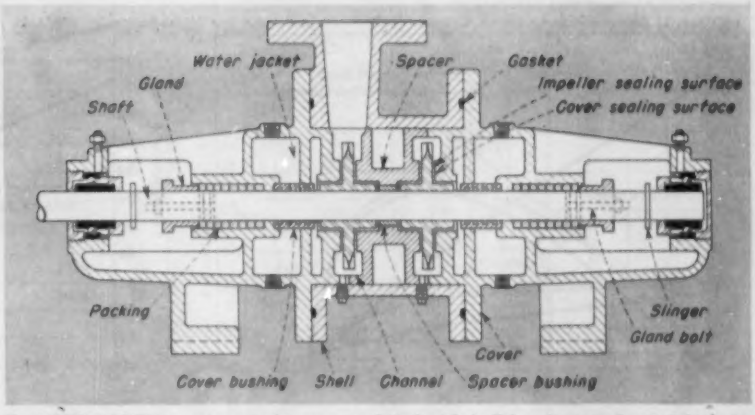
In a radial-vane turbine pump, Fig. 5, the liquid enters a channel on both sides of the impeller at a point adjacent to the discharge. It is carried around by the vanes for almost a complete revolution and is then diverted through the discharge opening by the block, Fig. 5. This is sometimes termed peripheral flow, which combines with radial flow through the impeller vanes to form the pattern in Fig. 5.

Impeller diameter and its rpm fix the centrifugal force that can be converted into pressure in a centrifugal pump. In a turbine pump, liquid is recirculated between the vanes, Fig. 5. So the energy supplied the liquid is the result of a number of impacts, or impulses, given it by the impeller vanes while traveling a long distance from inlet to outlet.

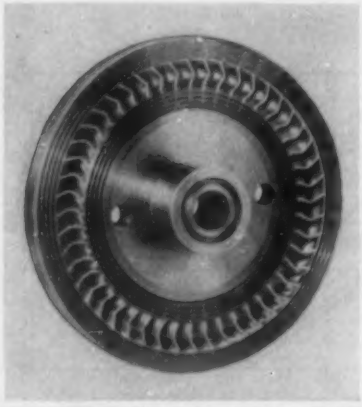
*The word *turbine* is loosely applied to a number of different types of centrifugal pumps, especially deepwell. In this article it is used in its correct sense, applying only to a regenerative-type pump.



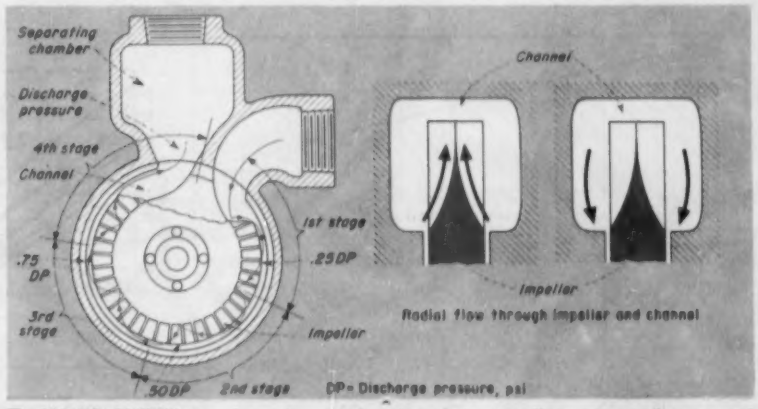
2 **RADIAL-VANE** impeller is the most common type. It is double-suction



3 **LATE-MODEL** two-stage turbine pump fitted with ball bearings and water jackets. Note how shell and cover take the place of the casing in a centrifugal pump



4 **INCLINED-VANE** impeller has blades on only one side of the disk, as shown



5 **LIQUID ENTERS** the channel on both sides of the impeller vanes and is carried through an almost complete revolution. Arc shows equivalent centrifugal stages

plant operators for specialized jobs

This series of impulses can be compared to multistaging of centrifugal impellers. Fig. 5 shows how the pressure developed in the sectors of a single-stage turbine pump can be compared to a 4-stage centrifugal having impellers of the same diameter and turning at the same speed.

Head. Maximum head developed by a centrifugal can be computed with fair accuracy, but this is not possible with a turbine pump because impeller diameter is not directly related to maximum head.

Multistaging. Fig. 3 shows a 2-stage turbine pump having a spacer casting that carries half the channel for each impeller. Other half of each channel is in a cover casting. Liquid is discharged from the first stage through a cross-over to the second stage.

Multistage turbine pumps have been built as horizontal and deepwell units up to five stages. But most designs are single- or 2-stage.

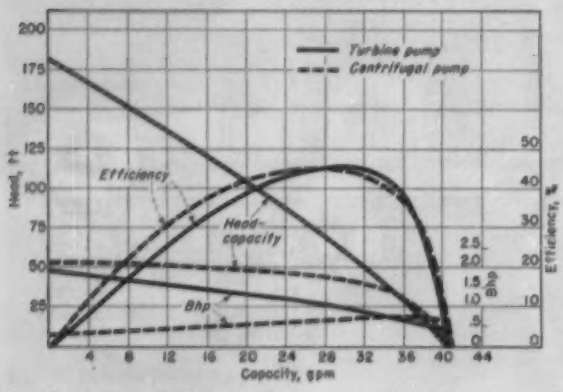
Characteristics. Fig. 6 shows characteristic curves for a turbine and a centrifugal pump. As you can see, the head-capacity (H-Q) curve for the turbine pump is steep, compared with that for the centrifugal. Both impellers whose characteristics are plotted in Fig. 6 are turning at 1750 rpm; diameter of the turbine-pump impeller is 4.5 in., centrifugal-pump impeller 7.0 in. Note the similarity of the efficiency curves.

The general characteristics of a turbine pump are: capacity decreases gradually as discharge head increases, horsepower increases gradually as discharge head increases, efficiency increases gradually to a maximum and then gradually decreases as discharge head increases. Fig. 6 shows these facts for one particular pump.

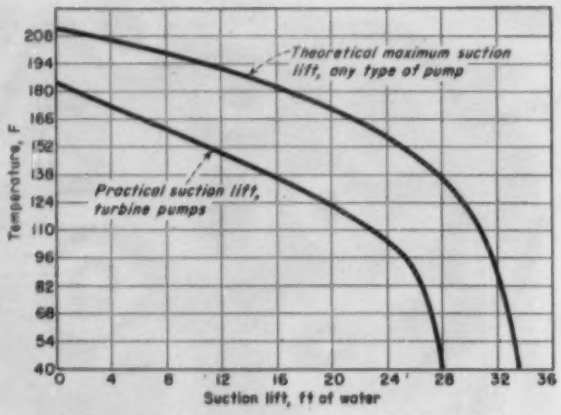
Lift. Turbine pumps have the most favorable lift characteristics of any class of pump. Fig. 7 shows that the maximum practical suction lift of a turbine pump is within about 5.5 ft of the theoretical maximum.

Because of this lift characteristic, turbine pumps are well adapted for jobs where liquids must be lifted from a lower level, for handling hot water and volatile liquids like gasoline, naphtha, alcohol and others that vaporize easily at normal temperatures.

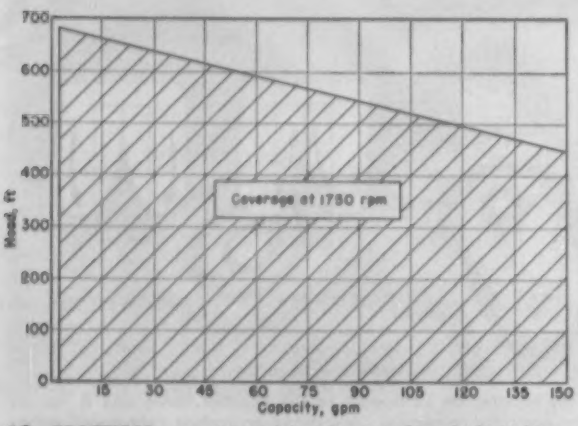
At lifts up to 22 ft, the turbine pump delivers full rated capacity. Beyond this lift, capacity gradually drops until 31 ft



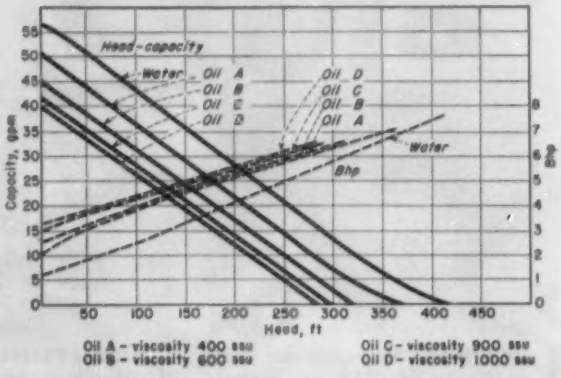
6 **HEAD-CAPACITY** curves for a 4.5-in.-dia turbine pump and a 7.0-in.-dia centrifugal pump; both turn at 1750 rpm


Theoretical maximum suction lift, any type of pump
Practical suction lift, turbine pumps
Temperature, F
Suction lift, ft of water

7 **COMPARISON** of maximum theoretical suction lift for any type of pump and the practical lift for a turbine pump



10 **PRACTICAL** capacity and head range for which turbine pumps of modern design and construction are best suited



11 **VISCOSITY** increase of the liquid handled raises power input to a turbine pump and reduces the head developed

These curves show the important characteristics of the modern turbine pump.

is reached, when the delivery will cease.

Npsh, or net positive suction head, varies from one pump to the next, depending on capacity and inlet-opening size. Fig. 8 shows npsh needed for turbine pumps of conventional design operating at recommended speed, to obtain the full cold-water rating. Dotted curve is the minimum npsh for satisfactory operation.

At minimum npsh, pump capacity is reduced, particularly at lower heads on the performance curve. Fig. 9 shows the effect of a low static head on the delivery of a typical turbine pump handling hot water.

Use. The steep *H-Q* and rising power characteristics of the turbine pump give the unit a wide operating range with only slight capacity variation, even though head varies considerably. The rising power characteristic is similar to that of a positive-displacement pump.

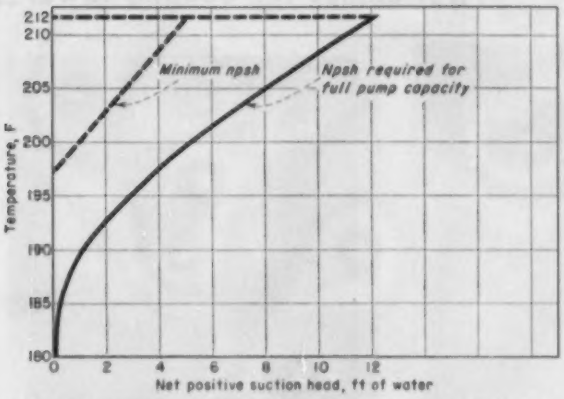
Turbine pumps are commonly applied for handling clear liquids at suction lifts from 28 ft at sea level, to suction pressures up to 300 psi, and for developing differential heads of 10 to 500 ft of liquid. These are not exact limits because turbine pumps have been used on jobs with higher suction pressures, and for differential heads as high as 1800 ft.

With the trend toward higher pressures in boiler-feed service, process and other industries, the field of application for turbine pumps, as far as pressure is concerned, can be said to be limited only by demand, economics, and the manufacturers' ability to develop and produce the required sizes.

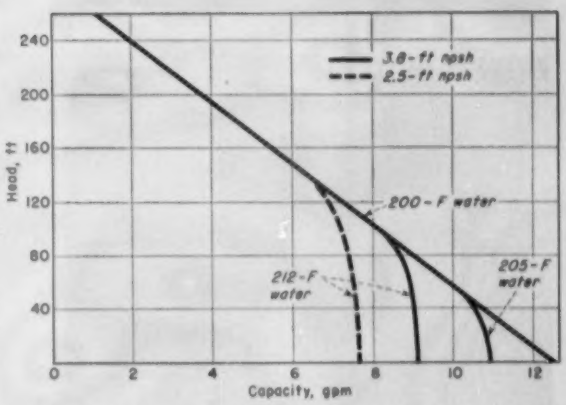
Capacity limits are fixed by the operating economy of the turbine pump compared with that of a centrifugal. Though turbine pumps have been built for capacities to 450 gpm, this type of unit has much lower efficiency than a centrifugal pump at capacities greater than 150 gpm. So the demand for large-capacity turbine pumps is almost nonexistent.

Practical capacity and head range for which turbine pumps are best adapted is from 2 to 150 gpm at heads from 10 to 680 ft, Fig. 10.

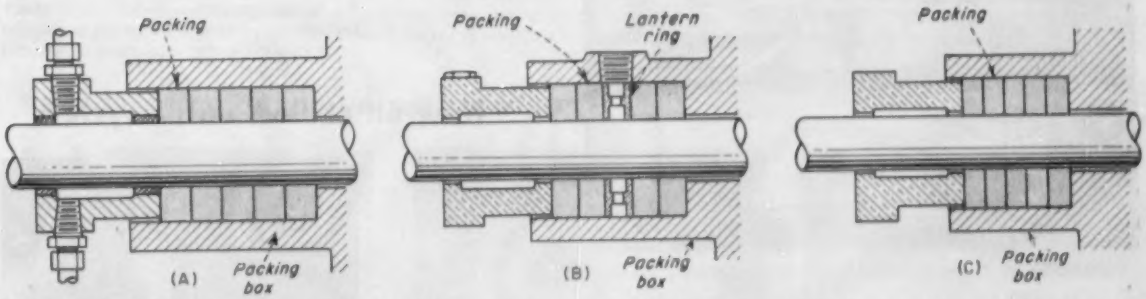
Other conditions, which must be considered when using turbine pumps, are liquid viscosity and solids content. Liquids exceeding 500 ssu excessively reduce capacity and greatly increase power needs. Resulting efficiency de-



8 **NPSH REQUIRED** for turbine pumps of conventional design, run at recommended speed, to give full cold-water flow



9 **EFFECT** of low static head on the delivery of a typical turbine design pumping hot water at different temperatures



12 **SMOTHERING GLAND,** *A*, is used where liquid handled by pump would be dangerous or objectionable if it leaked to atmosphere. Split gland *B*, made in two halves, is easily removed. C is the solid-type gland, used where there is room

which is being used for many jobs today

crease is so large, compared to a positive-displacement pump, that the turbine pump is seldom used for high-viscosity liquids. Fig. 11 shows the effect of liquids of various viscosities on normal operation of a turbine pump.

Turbine pumps cannot efficiently handle liquids carrying solids in suspension, particularly if the solids are abrasive. Small clearances in the turbine pump ordinarily prevent the handling of abrasive slurries.

Each turbine-pump size, operating at a constant speed, develops its maximum efficiency at a specific capacity and head, Fig. 6. While this point might be called the rated head and capacity for this size pump, the useful operating range covers a large number of head and capacity values, where efficiency is lower, but still within desirable limits. All selection tables published by turbine-pump manufacturers take this into consideration because it reduces the number of pump sizes needed to cover the field of application.

Construction. As shown in Fig. 3, the casing of a turbine pump consists of the shell and covers. Both these parts are usually of the same material: iron, steel, bronze, stainless steel or special alloys.

Plain, L or labyrinth seals may be used for the impeller, Fig. 13. Stuffing boxes, Fig. 12, may be solid-packed or injection type, depending on the pump design. Common packing materials used include asbestos, flax, lead foil and aluminum foil. Teflon and cotton are also used in certain types of applications.

13 **PLAIN** sealing surfaces, *A*. L-type seal, *B*. Labyrinth seal shown at *C*

COMPRESSOR is the heart of your air-conditioning system

Let's get your air conditioning set for hot days ahead

Here's step-by-step method The Thermodyne Corp uses to get your air-conditioning system in service—and keep it running smoothly

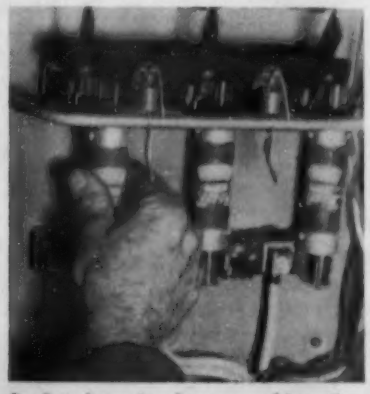
First comes the cooling tower

1 Inspect and clean your cooling-tower spray nozzles. Make this check periodically during the operating months since cooling water may carry some dirt

Now fill chilled-water system

5 Keep chilled-water-system vents open to purge trapped air while filling

Next, electrical check



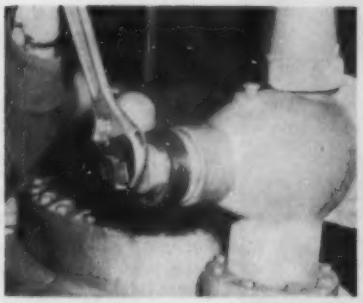
9 Put fuses in place on refrigeration, tower and the chilled-water circuits

2 As part of general cooling-tower servicing, scrape out any sand or dirt that has accumulated in bottom of water pan. Make sure tower fan belts are tight

3 Close tower drain valves and fill water system. Purge air from cooling-tower pump by opening air vent until water flows out. Then close the air vent

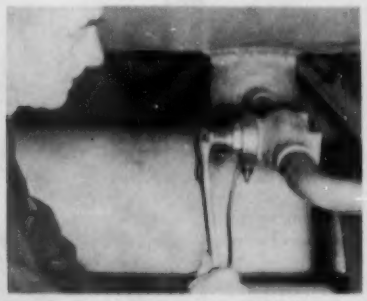
4 Turn cooling-tower-pump shaft. It should turn over freely. To complete the cooling-tower system servicing, oil or grease pump, motors, fan, bearings

Refrigeration: Open valves slowly



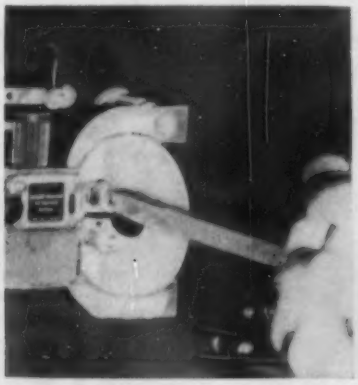
6 Swinging over to the refrigeration compressor, open discharge-side valve

7 After opening hot-gas valve to condenser, open compressor inlet valve



8 Open liquid-line valve to chiller. Inspect the condition of all valves

Air side: Clean, inspect it



10 Check all electrical connections. Tighten up any loose terminal nuts

11 Remove and inspect the air filters. Clean thoroughly or replace them

12 Test belt tension on the air-handling fan. Make sure the belt is clean

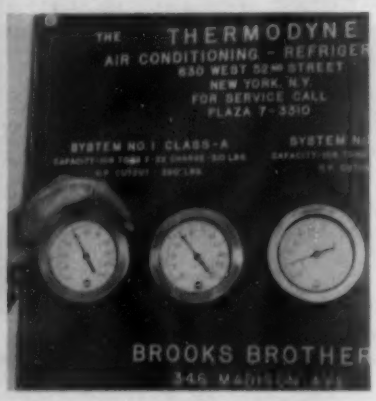
Putting the system to work ►

Finally, let's put system to work

13 Throw the main switch on cooling-tower circuit. To see that water is circulating, inspect flow at the sprays

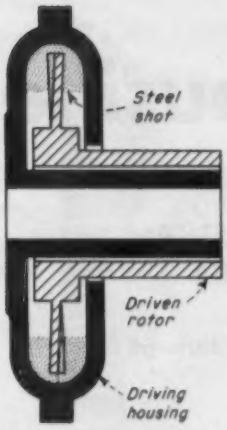
14 Close main switch supplying power to chilled-water pump. Don't forget to read the discharge-pressure gage

15 After throwing main switch at refrigeration compressor, allow it to run for half hour to an hour, before making checks, to bring system into balance

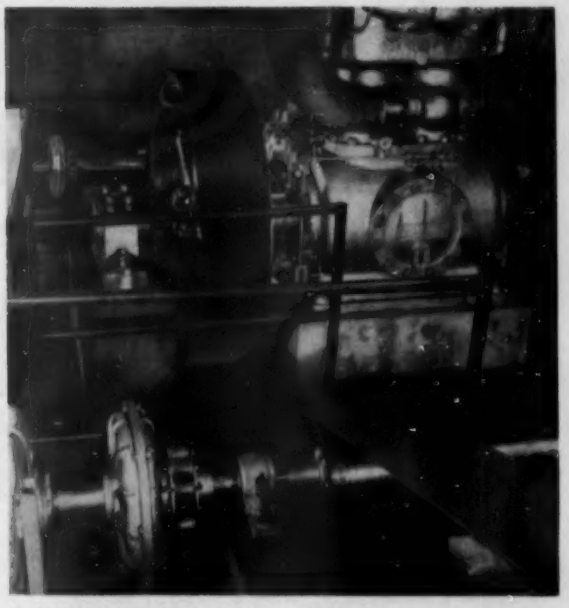


16 Read operating head and suction pressure. High head can mean air in system, clogged cooling-tower lines. Low head may be result of a gas shortage

17 Take close look at sight flow, with white card or flash light. Clear glass indicates a full liquid line. Low refrigerant is cloudy or forms gas bubbles



How drive works: Motor connected to housing starts it turning at no load. Steel shot, compressed by centrifugal force, turns with the housing. Rotor is started and accelerated by friction and wedging action of the shot. At normal running speed, rotor and housing turn at the same rate, with no slip



EUROPEAN VERSION of the new drive gives good service in this French compressor installation. Note the two identical units

New drive uses steel shot as 'fluid'

► USING STEEL SHOT as a medium for transmitting power, a new "fluid" drive eliminates the slip between input and output members that is common to the ordinary hydraulic drive.

The unit differs from a hydraulic drive. In a hydraulic unit, there are primary and secondary elements. The primary one acts on the fluid like a centrifugal pump impeller, while the secondary takes the power like a waterwheel to drive the load.

In the new drive, centrifugal force throws the shot to the circumference of the housing, where it turns with the housing. The rotor, which is connected to the load, is free to turn concentrically. It is started and accelerated by the friction and wedging action of the turning steel shot. At normal operating speeds, there is no slip. Yet the rotor is so designed that it will slip if there is an overload. You can change the point where the slip starts by changing the amount of shot in the housing.

This drive is especially useful on heavy-inertia loads, such as compressors, centrifuges, conveyors and crushers. When the motor is started, the drive produces a constant torque for a given input speed regardless of the percentage of slip between rotor and housing. Load comes up to speed gradually, until there is no slip. With an overload, the rotor slips relative to the housing, overcoming the friction and wedging action of the steel shot.

Developed in France, this drive has had many successful applications there (see photo above). It has been redesigned to American standards by the Dodge Manufacturing Company, which calls its unit the *Flexidyne*.

Described as a dry-fluid drive, the *Flexidyne* can be set to slip at anywhere from as low as 20% over full-load torque to as high as peak motor torque. During starting and overload periods the current draw is at a minimum because the motor is never pulled down to less than 90% of synchronous speed with the standard setting.

Smooth starts and controlled overload protection avoid breakage and reduce maintenance on drives, gears, bearings and driven machinery. Compared with direct connection, smaller, cheaper motors and controls can be used, with reduced current demands and improved power factor.

The steel shot is easy to seal in, has a high density and can stand relatively high temperatures. Maintenance required for the unit is said to be practically negligible.

Unit will be available in two lines: (1) a drive for mounting directly on motor shafts and adapted for use with sheaves, and (2) a coupling for straight-line drives.

Photo at left shows an application of the first type of unit. The *Flexidyne* drive picks up power from a ¾-hp squirrel-cage motor. Power is delivered through a V-belt drive and a speed reducer mounted on the drive axle shaft. This drive moves the foundry cart smoothly to the exact location desired.

PUSHBUTTON controlled foundry cart using the new drive carries a 2-ton load

Safety is your business

- *Accidents cost us $10 billion in 1953. And part of that bill came out of your pocket*
- *One sure way to trim this figure is through safety selling. Here are a few tips*

► WE ALL GIVE LIP SERVICE to plant safety. But if the staggering figure for accident costs is to be trimmed back, we as engineers must play a more active part.

Preventing industrial accidents is basically an engineering job. Yet power men seldom look upon safety engineering as part of daily responsibilities. If we did, the boiled-down statistics in this article on industrial-type accidents would be sliced way back.

Safety engineering as such is a new profession that has grown up since 1912. At that time insurance companies writing policies under the newly enacted Workman's Compensation Insurance Acts realized the best way to prevent accidents is to stop them before they start.

Well-seasoned safety people agree that selling plays a top role in putting across any plant-safety program. First, management must be sold. And once they're convinced the proposed safety plan is worth the time and money required, the selling job has just begun. Safety must be sold to every man in the plant.

As a power man you are responsible for the plant power services and the safety of men carrying out your orders. Don't leave the sales job to the safety people alone. Weave your selling job in with any plans that the production people have.

How to sell? Let's look at a page from the safety record of a munitions plant during World War II. Here women flatly refused to wear safety goggles in a particular grinding operation. It was a simple case of vanity. And nothing the foreman or plant manager said would change their minds. Then a safety engineer from one of the large insurance companies tried his hand.

His approach was to single out the girl who headed up the antigoggle crusade. In an official atmosphere he handed her an object with the advice that she would be needing it soon. "It" was a glass eye, blue to match her own. The antigoggle crusade evaporated. Corny? Perhaps . . . but it's the results that count. If any scheme you cook up makes the men in your plant more safety conscious, your scheme is OK.

Take the approach of the Charles Pfizer Co (POWER, April 1954, p 86). Here the safety engineer set up 12 monthly safety themes. Each theme geared the plant's accident-prevention program for that month toward avoiding the mishaps most likely to occur in that particular month.

How did that scheme come about? This plant found, after a close scrutiny of medical-department records over a 10-year period, that there was a discernible pattern in plant accidents. There were more slips and falls in February than in any other month, more strains and sprains in September, more eye accidents in March. With that as background, they set out to prevent the most prevalent accidents each month.

Many plants can point with pride to the records they are chalking up. The National Safety Council points out DuPont's Old Hickory plant as the one having the best no-injury record. This plant has tallied close to 29 million man-hours without a disabling injury. There is a long jump to the second best: Westinghouse TV-Radio plant in Sunbury, Pa. with over 19 million. If you want to compare your frequency-rate and severity-rate with the average for your particular industry, match your figures with those on the facing page.

Proper job habits are a sound footing for any safety plan. When you are doing a job right, you are doing it safely. According to the National Safety Council, handling objects comes in as the principal source of compensable-work injuries. Close behind are falls, with machinery accidents third. These big three account for 22, 17 and 16% of all disabling injuries—and in that order.

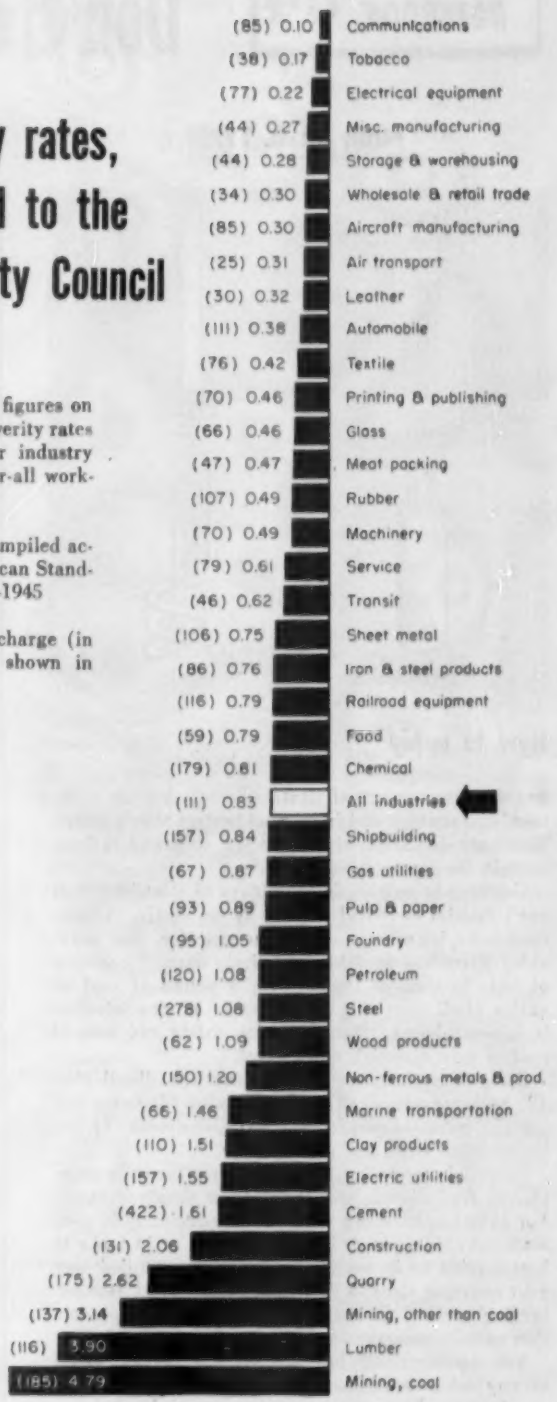
In every plant you will find that accidents are caused by unsafe acts and unsafe conditions, mostly by unsafe acts. Among more than 100,000 work accidents reported in Pennsylvania in 1951, an unsafe act and an unsafe condition were identified in about 95% of the accidents classified.

Does a man's age come into the accident picture? Yes, but not as you may think. The injury-frequency rate for older workers is not as high as in the age group from 35 to 44 years. Of course, you must consider the cold fact that people in different age groups may not be doing the same type of work. Older men are more often found in supervisory spots or other less hazardous occupations. But we believe the statistical scales tip in favor of the oldsters because of their safety experience built up over the years.

But regardless of age, there is one area where a big chunk of today's accidents occur: simple falls. We say *simple* since falls usually occur on floors or other level surfaces. Our statistical source shows that falls alone account for injuries to 450,000 people on the job each year. Principal contributors to these falls are loose objects on the floor, wet or oily surfaces. This staggering figure of 450,000 could be trimmed substantially by closer attention to the simple rules of good plant housekeeping. And that's right within your bailiwick.

1953 injury rates, as reported to the National Safety Council

- These relative figures on frequency and severity rates show where your industry stands in the over-all work-injury picture
- Figures are compiled according to American Standard Code Z 16.1-1945
- Average time charge (in days) per case shown in parentheses



Frequency rate

This is the number of disabling injuries per million man-hours of exposure. Cases are not included where someone is injured, but loses no time. To help prevent future injuries, check causes of all accidents, even minor ones.

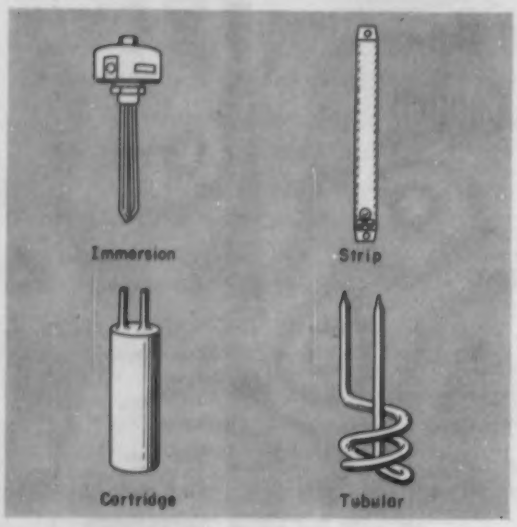
Severity rate

This is the number of days lost per 1000 man-hours of exposure, including charges for permanent disabilities and deaths. Note: This is not same time exposure used for frequency rates. 1955 figures will have the same base.

OPERATORS' NOTEBOOK 84

Don't overlook these handy

FOUR BASIC TYPES



How to apply

► FOUR BASIC TYPES of electric heaters are the strip, tubular, cartridge and immersion heaters shown above. There are thousands of other types, sizes and ratings, though, for you to choose from.

Contrary to opinion in early days of electricity, you can't dismiss electrical heating as too costly. Adding total costs, it's often the most economical method available. Electrical heat is a relatively expensive source of heat in theory. Potential in a pound of coal or gallon of oil costs only small fraction of its equivalent in kilowatt-hours. But simplicity, safety and ease of control may outweigh energy cost.

Some advantages are (1) uniform heat distribution (2) accurate control (3) low initial cost (4) space saving (5) instantaneous heat-up (6) cleanliness (7) low maintenance costs and (8) long life.

Potential cost-saving applications are found in many plants. And electric heaters are often simple to apply. For example, heaters are inserted strategically in your machinery, in ducts to heat process air, or in tanks to heat liquids by immersion. They're also applied over your conveyor lines to dry, fuse, cure, etc, by radiant-heating method. Or they can be fitted to your production setup in numerous ways.

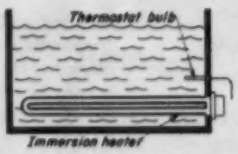
You can electrically heat air, water, oil, grease, metal or any other substance you process. And you can attach these heaters to your present tanks, vats or other vessels. Sketches will give you a start.

Two steps to consider for electrical heating are: (1) Calculate your heating requirements, then select heating unit best adapted to your job. (2) Choose either the individual heaters or the packaged assemblies, complete with heating elements, insulation and temperature controls.

Courtesy: Edwin L Wiegand Co, Pittsburgh, Pa.

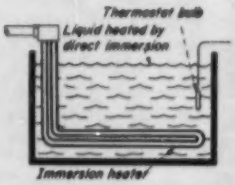
OPEN TANKS

Permanent heaters



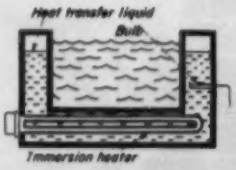
Permanent heater is installed here inside of tank with screw plugs or flanges, depending on job. Use where a permanently installed heating capacity is preferred, where portability isn't important. Some uses are for wash or rinse tanks, or for any open or closed hot-water tank. Here thermostat bulb and coils are fixed inside tank. They are easy to install.

Direct immersion



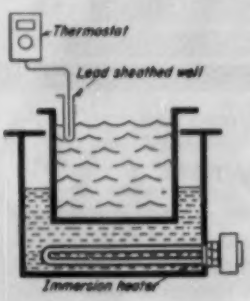
Portable electrical-heating element is immersed directly in open tank. Here's a convenient way to heat your water for many uses, where permanent heater isn't economical. Heater rests on tank bottom, is easily removed after heating is complete. Then you can place in another tank. Thermostat bulb, in liquid, controls temperature that you set it for, as shown.

Indirect immersion



Indirect-immersion heater is placed inside jacketed kettle. This hookup gives uniform, controlled heat distribution over entire areas of inner wall that contains materials to be heated. Use for materials easy to carbonize, for hard-to-heat materials like glue, molasses, resins. Pharmaceuticals and medicines are heated thus.

Jacketed tanks



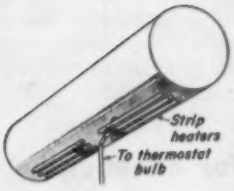
Jacketed tank with built-in, adjustable thermostat heats water in this lined electroplating tank. Heat is easily adjusted to suit various plating solutions. Here bath tank usually operates at 130 F. Controlling thermostat in solution prevents temperature overrun, which would damage lining. No chance of contamination from leaking coils.

electrical heating methods

By STEVE ELONKA, *Associate Editor*

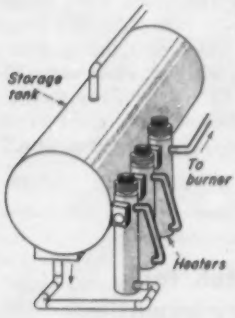
HORIZONTAL TANKS

Strip heaters



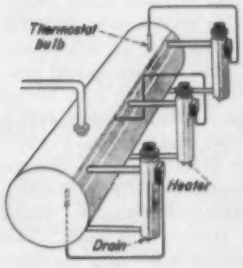
Strip heaters are clamped to studs welded to tank. Heaters are easy to install, spread warmth evenly over entire tank bottom, where heat is needed. A thermostat regulates heat at temperature desired. For this type installation, you can apply insulation over heaters and shell of tank to save as much heat as possible. Strips can be placed on tanks of any shape.

Sidearm direct heating



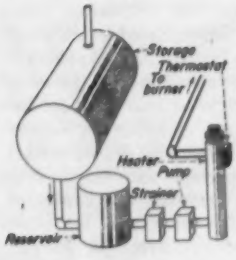
Sidearm direct heating is useful for large quantities of fuel oil. Use a storage tank and these heaters, through which oil is circulated. Advantages include positive temperature control that's automatically adjustable to flow rate. Circulation heaters and storage tanks permit storing large quantities of oil with low installed kilowatt capacity.

Sidearm heating



Here is automatic, controlled heating for a large quantity of water with smaller installed electrical capacity. It also allows inexpensive storage of large quantities of hot water at off-peak rates. Use where you need hot or rinse water, for process tanks, kettles, etc, also instead of central heat in summer when plant steam is off.

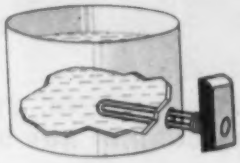
Direct circulation



Place direct circulation heaters in direct line of flow from storage. Hookup is ideal for heating heavy or light fuel oils in cold weather. Small quantities of oil are quickly preheated with this setup to increase combustion efficiency, regardless of oil's weight or outside temperature. Also handy where preheat is needed (even in warm weather).

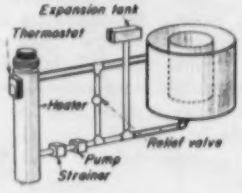
OTHER APPLICATIONS

Built-in thermostat



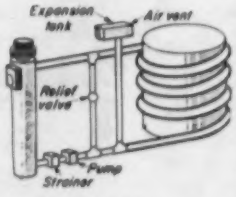
Immersion heater has built-in thermostat, is easiest and quickest to install. Comes in many sizes, shapes, heating capacities up to 10 kw. Install a number of heaters near bottom of horizontal round-tank, so they extend in toward center, as spokes of wheel. This heater solves problem of crowding in large capacity for fast heating often needed.

Jacketed kettle



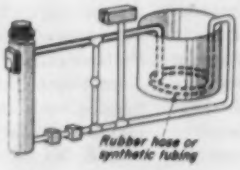
Circulation heater provides uniform, accurate heat at all points for materials easily damaged by spotty overheating. Examples are glues, resins, plastics, pharmaceuticals, high-temperature processing of chemicals. These "packaged" heaters are compact, provide convenient heat source, with uniform heating over a wide temperature range.

Coil outside tank



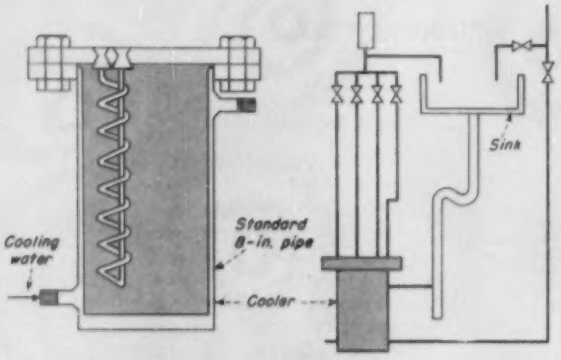
Outside coil for heat-transfer system is answer where tank is subject to corrosion. Heating system is same as above, except for coils in place of jacketed kettle. Here heat-transfer liquid is heated, circulated around outside of tank, doing away with contamination danger in tank or coil leakage. You can insulate coils, tank.

Coil inside tank



Inside coil is widely used where corrosion is so bad you must use a rubber hose or synthetic tubing for indirect heating. Here again, the heating system is same as above. Only difference is in the way coil is applied to the kettle. Heat-transfer fluid can be water or any heat-transfer fluid commonly used in process work. Just coil hose inside tank.

Latest PRACTICAL IDEAS to help you do a



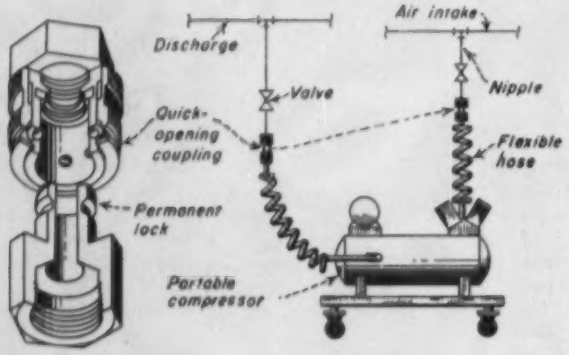
New water-testing cabinet has built-in cooler, storage for chemicals

TESTING BOILER FEEDWATER is a daily job, but we didn't have the facilities for doing this conveniently. I designed a large wooden cabinet, complete with sink and storage spaces for chemicals and test equipment.

We also built a high-pressure cooler and installed it under the cabinet's sink. Blowdown of two boilers, deaerator outlet and condensate returns are piped to the cooler. A thermometer above the sink near the valves for controlling temperatures tells us when we have exact temperature needed for testing.

Coils inside the cooler were wound around a 1½-in. iron pipe. We found that 5/16-in. OD copper tubing didn't collapse when winding, while larger diameters did. City water flows through cooler, is regulated with globe valve.

M A CAMPBELL *Montreal, Que.*



Here's my idea on Weum's zoned air

IN DECEMBER, p 146, D Weum describes zoning. Value of a multiunit compressed-air system may be increased by having at least one portable compressor for various parts of a building, also other buildings of a multiplant installation. Sketch shows how to arrange it.

Mobile compressor is pulled to a location, then tied into the existing intake and discharge headers. Flexible hose (rubber or metal) is connected between the shutoff valves and compressor by quick-acting couplings. Sketch shows details of one coupling; many types are available.

Value of this hookup is for plant of several buildings where compressed-air demand varies from nothing to amounts in excess of stationary unit's capacity. Portable unit gives reserve capacity, doesn't need high capital investment. Special tools and skilled labor aren't required to make system operate.

H B WAYNE *Brooklyn, N. Y.*

Knife switch fails from faulty insulation

A POWER-STATION GROUP of 440-v 3-phase auxiliary motors had an oil circuit breaker and a 3-pole knife switch for disconnecting service rated at 600 v, 600 amp. Load at time of failure was less than 300 amp. Failure caused complete destruction of switch, with circuit and station interruption. A spare switch from station stock was installed at once.

While cause of failure had not been found, we inspected the new installation often. After 24 hours, we found smoke rising from switch yoke. This was connecting piece between the three blades. Inspection showed the insulating yoke to be too hot to touch. We removed switch at once and replaced with three single-pole switches.

Manufacturer told us switch yokes were made of impregnated paper stock, treated with a lye solution. Apparently the washing following the lye treatment was not complete as yoke was conductive enough even at 440 v for current to flow. That eventually caused failure, even though current was very low in value. Switch materials are important.

C O VON DANNENBERG *Brooklyn, N. Y.*

better job and cut your costs

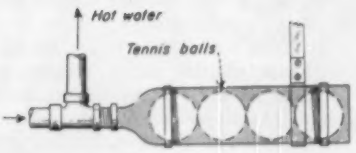
STEVE ELONKA, *Associate Editor*

How to ground your shaft

IT'S USUAL to ground the casing of machines, but not so with rotating shaft. Oil film in bearings more or less insulates shaft. Any current leakage to earth will have to break down this film.

Shaft can be earthed with a piece of thin springy steel, drilled at one end to take a carbon rod. Slot and weld on brackets, then fit with tightening screws to clamp the carbon. Weld steel to frame of machine adjacent to shaft. Then carbon rod can be adjusted to bear on the shaft as it rotates.

W E WARNER
Woódford Green, Eng.



Tennis balls absorb water hammer

WE INSTALLED automatic dishwashers and other equipment with electrically operated solenoid valves to control water flow automatically. These jobs are placed where water hammer is a serious problem.

We found that air chambers usually don't lick the problem because they absorb air. There's often no maintenance setup for periodic drainage to recharge air supply. And commercial devices are too small for effective service.

To control water hammer, we install on all automatically controlled systems a pressure-reducing valve that limits pressure to lowest effective level. We use shock absorbers (made on the job) as in sketch.

Shock absorber is built up of standard pipe fittings. Air chamber is maintained with four first-grade tennis balls inside pipe chamber. Tennis balls are far enough removed from heated pipe to prevent deterioration. This, and the fact that they're in water inside a dark chamber, gives them very long life. Air or gas inside tennis balls isn't lost, so shock absorber remains serviceable for many years.

Absorber works in any position at some convenient place on the line, on both cold- and hot-water lines. Here's an idea that works surprisingly well.

E F WEHLAGE *Fairport, N. Y.*

Don't let this happen to you

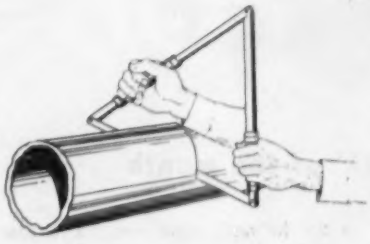
DURING WORLD WAR II, I was piping draftsman on a large new base for naval personnel. Buildings were hospitals, mess halls, galleys, offices and barracks. Each building had its own steam boiler.

Two of the largest boilers were 500 hp of 100 psi, but they arrived late. Order of the day was to rush because these boilers held up schedule. So night crew took over where day crew left off. Everything was going fine. But four days before settings were to be finished, a young engineer was assigned to job.

He claimed our men were wasting time by allowing brickwork too many days to dry thoroughly before firing boilers. To show his authority, he ordered boilers fired two days before construction boss set time.

His orders were carried out, and boiler settings were so badly warped out of alignment that both boilers had to be reset. That really put our project behind time. It pays to listen to experienced mechanics, I've found, regardless of how much book learning one has. Don't let this happen to *you*.

S R HIGGINS *Long Beach, Calif.*



No large hacksaw? Use blades

HERE'S a novel way to cut a piece of work where depth of cut is more than frame of saw. Bolt several blades into a triangle, sketch, using five blades. You can cut inches deeper than with any hand hacksaw frame. Tape blades or use gloves. This idea also works if you have lost or forgotten your frame.

C H WILLEY *Penacook, N. H.*

Drum for machinery makes good guard

A 55-GALLON DRUM, split longitudinally, makes a good cover for small machinery if subject to splashing, dripping or other dirt. Mount drum-half on legs and raise off bedplate so air can circulate. Make drum easy to remove for servicing.

E R ECKERT *Fanwood, N. J.*

Did you know . . .

that double-spacing your typewritten lines on a contribution to any publication helps the editor handle your material more easily? His editing takes up space on your manuscript and if you don't provide space between lines, the editor often has to retype a manuscript.

(*Continued on page* 134)

More PRACTICAL IDEAS

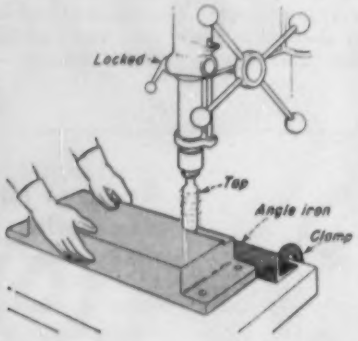
Begins on page 132

More bricks stopped erosion

WE HAVE two oil-and-gas-fired A-type package boilers, but torn refractories from burner erosion were a problem. High ratings in excess of 200% caused high-temperature gas flow to warp refractory.

First photo shows three rows of brick we added to original refractory on furnace floor. Second photo shows finished job, with bricks covered with plastic refractory. This didn't reduce furnace volume enough to lower capacity. We used a high-temperature brick-kiln refractory and a high-temperature brick. Revised installation has not required maintenance for over three years.

L W FITZPATRICK
Jefferson City, Mo.



Here's your 'trick' of the month

ELECTRIC MOTOR on one of our production machines burned out. As luck would have it, our spare motor's dimensions from base to shaft were ¼ in. too high. Problem was to plane down the aluminum base under the burned-out motor, which has a direct drive.

This unit had to be in full operation as soon as possible. Our plant has a small machine shop, but with about 16 sq in. of base metal to remove, things looked hopeless.

We took a ⅜-in. high-speed tap, and ground threads from the four threaded flutes, making them slightly concave so the forward edges would cut, also ground end concave so we could use as end mill. Then we chucked the tap into our drill press, set it on high speed and locked it for depth. Next we C-clamped an angle-iron guide to the press table and fed the aluminum base slowly against the tap by sliding the base against the angle iron.

We tap-milled the excess ¼ in. from surface in two passes of ⅛ in. depth each. With this "milling machine" coming to our help, we had the production unit back on the line in exactly 90 min.

F C MCMAHON *West Belmar, N. J.*

Cut down your smoke with overfire steam jets

WHEN PLANNING jet systems for overfire operation to assist in smoke elimination, don't overlook the many simple things available in every plant. Steam jets have lower initial costs than air-jet systems. You can make them with 125-psi pipe fittings and standard-weight pipe.

Exhaust steam from oil pumps is OK and oil content isn't important, since jet action disperses this oil emulsion in furnace. You can also use turbine blowers run by exhaust steam, although the cost is much more than with steam jets. Another possibility is air from forced-draft systems. This is installed at lower cost than steam jets where high turbulence is not required and furnace area is comparatively small.

Selecting jet-system pressure, consider minimum effective steam pressure on basis of jet and furnace design. Some steam-jet jobs operate OK on pressures as low as 5 psi. However, fuel-bed penetration and turbulence drop, with decrease in steam pressure, take more jets for good coverage when using low pressures. Usually, 25 psi is lowest pressure in newer installations to eliminate need for extensive bulky jet coverage of furnace.

General practice is to use about 10% of air theoretically needed as overfire air for fuel combustion. With load variations or where quantity of volatile is released suddenly, quantities as high as 25% may be required.

If excess air in furnace is hard to control and only turbulence is needed, quantities as low as 3%, at relatively low velocities from pressures around 5 to 10 psi, can be used.

Most modern jet jobs have steam nozzles on header that can be removed for servicing while boiler stays in operation.

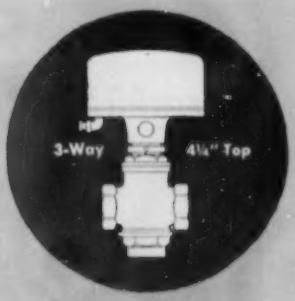
Always valve your jet assemblies so steam can be reduced on low load. Photoelectric controls help to indicate need of overfire jet operation. These controls are usually programmed to open an electric solenoid valve admitting jet medium to piping system. As soon as smoke condition clears, valve closes. Systems are simple, fully automatic, and conserve steam or air when not required in furnace.

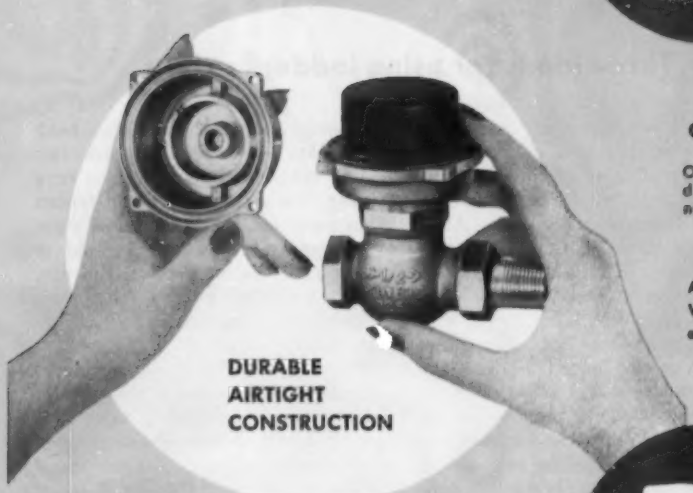
Overfire jets, besides preventing smoke and flyash emission, also reduce slag and soot formation on boiler tubes. Final boiler temperatures are also reduced and flame shortened. Smoking limit of boiler is increased together

(*Continued on page* 136)

POWERS

First with duo-seal PACKLESS CONTROL VALVES



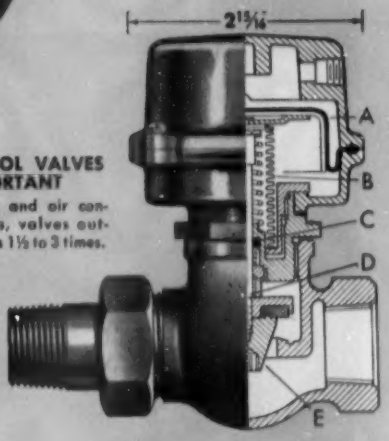


DURABLE AIRTIGHT CONSTRUCTION

GOOD CONTROL VALVES ARE IMPORTANT

On many heating and air conditioning systems, valves outnumber thermostats 1½ to 3 times.

Available in Various Types and Sizes

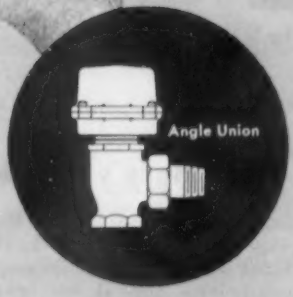


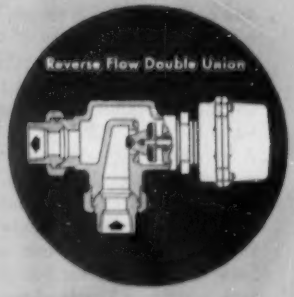
Rugged Cast Aluminum Top

A) Durable Molded Diaphragm
B) Bronze Bellows, Primary Seal
C) "O" Ring, Secondary Seal
D) Polished Stainless Steel Valve Stem
E) Characterized Throttling Nut

More ACCURATE Control with Powers PACKLESS Valves

Minimum valve stem friction. No packing nut or gland to be tightened, oiled or adjusted. No binding of valve stem as with conventional packing. Powers **duo-seal construction** assures better performance and—





No Packing Maintenance. No Leakage of Water or Steam. No Loss of Vacuum.

To insure getting a temperature control system with the best control valves made for convectors, unit air conditioners, unit ventilators, radiators, panel heating and cooling coils — specify or install POWERS control.

Call or write our nearest office for Bulletin 348

Established in 1891 • **THE POWERS REGULATOR COMPANY** • SKOKIE, ILL. • Offices in Over 60 Cities

(b73r)

More PRACTICAL IDEAS

Begins on page 132

with added efficiency. When coal is used, carbon content is reduced in cinder carryover.

If steam jets are used intermittently, remove condensation through a steam trap for better efficiency. Steam jets are efficiency bonus producers during summer when much waste steam is exhausted to atmosphere from steam-operated power-plant equipment.

L W FITZPATRICK
Jefferson City, Mo.

Save headwork: calibrate remote reading-gages

LOWERED WATER TABLES mean less water pressure in our plant. To keep up with demand, we must pump on a longer schedule than before. For a constant look-see at our main engineering office, we temporarily installed an 8½-in. gage and calibrated it for our main pumping-plant pressure.

We are 36 psi under their reading, so we carefully calibrated the gage by cutting the stainless-steel pointer. Then we soldered a 4-36 nut on gage shaft. A screw holds pointer-end snug after we added 36 extra pounds.

Dial graduations are shaded with red ink just under 90 psi. Between 90 and 99 psi, we use green ink, and then go back to red again for 100 psi, which is tank overflow. A pair of pressure snubbers take out pulsations and insure steady reading.

L W FITZPATRICK
Jefferson City, Mo.

Klaxon saves time

INSTALL A KLAXON HORN with a control button near your telephone. Then you can call any man in your plant to a phone easily. Dope out a system of signals. One blast for the chief, etc.

H HOLCOMBE *Los Alamos, N. M.*

Three ideas for using ladders safely

A. Don't set ladder at angle with vertical so small that a climber is in danger of toppling over backward. And don't allow angle with vertical to be so great that ladder might slip on a hard or smooth surface. If it must be set at a great angle, and there's danger of slipping, as when floor is wet or oily, brace legs as shown.

B. If a single-prop stepladder must be set with one leg lower than the other, tendency to overturn can be offset to a degree by swinging prop as far as possible toward leg at lowest level.

C. Before using a ladder in doubtful or unknown condition, place it flat, with 4-in. blocks under each end. Then, holding weights heavier than any to be carried up ladder, walk heavily from rung to rung. Turn ladder over and repeat. If no part of it breaks or shows signs of weakening, rungs may be said to have a safety factor greater than one. Sides of ladder are weakest when prone, so their safety factor is also greater than one.

Also: A new ladder should be painted with pentachlorophenol mixed with water. Under various trade names this and other preservative chemicals may be obtained from building-supply firms.

O LE BRACE *Oroville, Wash.*

Here's my idea on Pef's September headache

I DON'T AGREE with Pef's series hookup because there's no way of adjusting flow to individual requirements of each bearing. Also, if one bearing overheats, temperature of water fed to other bearings may be too low or too high.

Neither do I agree with system of leading all outlets to a common funnel at one end of machine. You need an individual funnel at each bearing, alongside valve, to see the flow.

In all my power-plant jobs since 1907, I have had an outlet funnel for each bearing. Main difference is that in 1907 I was instructed to stick my fingers in the water and feel the temperature, while today there are thermometers, temperature-control valves and high-temperature alarms. If you don't have modern devices, then funnel is reliable.

S T LIVINGSTON
Los Angeles, Calif.

1955
AWARD PROGRAM

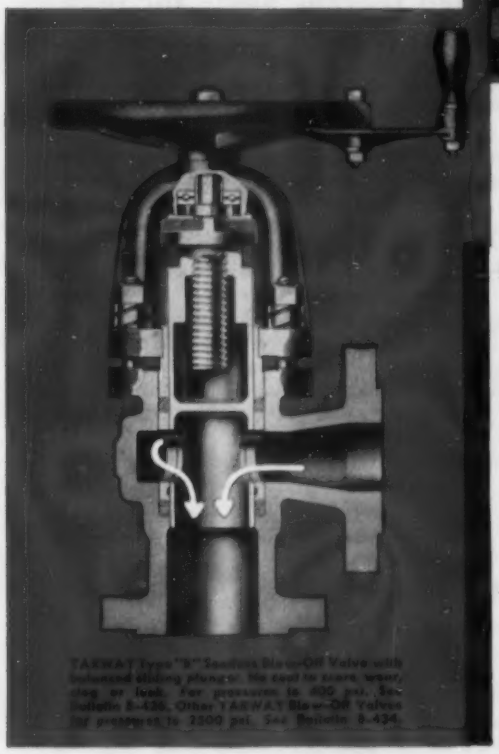
Have you recently modernized any of your power services? Tell us about it. You may be in the 1955 award picture. See p 95

Have you tried paraffin?

WHEN YOU HAVE TROUBLE with threads on bolts, studs or galling from high temperature (300 to 700 F), try melting a piece of paraffin against the threads.

Paraffin has excellent wetting and penetrating properties when melted against hot threads. Apply before equipment cools off. Paraffin is a good lubricant and does not vaporize as quickly as penetrating oil, does better job.

F C BUTCHER *Grifton, N. C.*



THIS PRODUCTION "DOUBLE CHECK" SAFEGUARDS YOUR BOILER INVESTMENT!

■ Yes, here is one extra production step we will never bypass! It is your guarantee of a *dependable*, long-life blow-off valve.

In this corner of the YARWAY Testing Department, *every Yarway Blow-Off Valve* is hydrostatically tested at 1½ times its rated maximum working pressure—proved drop-tight for service far beyond normal expectancy.

Not only blow-off valves, but *all* YARWAY equipment undergoes rigorous tests before leaving the YARWAY plant. Why? For one reason—to assure longer and better service in *your* plant. Over 15,000 boiler plants are using YARWAY Blow-Off Valves—some for twenty-thirty years, or longer.

Whenever you are in need of boiler blow-off valves, be sure to *make Yarway your way.*

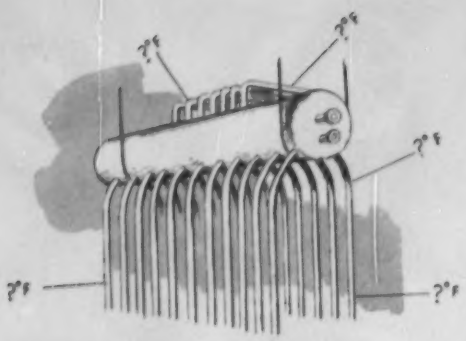
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY

steam plant equipment

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
REMOTE LIQUID LEVEL INDICATORS
EXPANSION JOINTS
DIGESTER VALVES
STEAM TRAPS
STRAINERS
SPRAY NOZZLES

This actual PLANT PROBLEM solved by



The question

Best way to measure tube temperature?

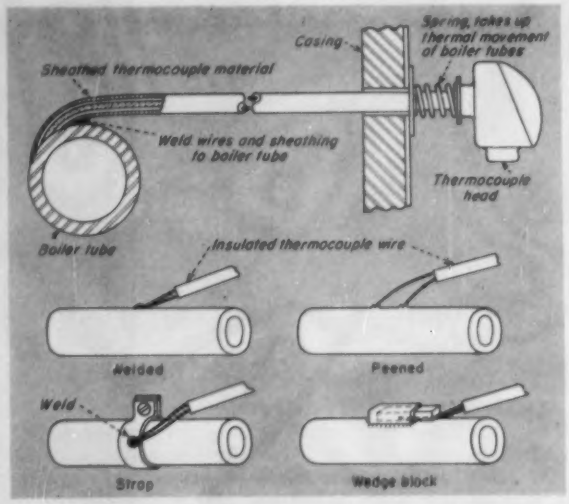
THE FACTS: We have a 400,000 lb-per-hr boiler whose tube temperatures we'd like to measure during operation. We feel that these readings are excellent guides to safe operation.

How can we install thermocouples in this boiler? What methods are used for attaching thermocouples to boiler tubes? Are spot-temperature measurements better than average temperature measurements? How do you protect thermocouples attached to superheater tubes? What are good materials for the thermocouple and its wiring?

We'd also like to know something about tube-temperature measuring instruments themselves, what the main features are and how they perform.

—LO, Jan Power

The answers →



Sheathed thermocouple for long life at high temperatures

WITH RISING TEMPERATURES for boiler operation, thermocouples must perform under conditions that are continually becoming more severe. To satisfy such needs, a sheathed thermocouple was developed that consists of a drawn stainless-steel or Inconel tube containing the thermocouple wires. Wires are insulated from the boiler tube by tightly packed magnesium oxide.

In use, thermocouple tube is welded to boiler tube, as shown above. Straps may be welded to the thermocouple tube to provide additional support if needed. Spring at casing prevents damage due to expansion or contraction of tubes.

Since avoiding hot spots is one of the main reasons for tube-temperature measurement, I believe average-temperature measurement is of little value. Measuring individual temperatures at strategic points will enable operators to get best operating conditions.

C R BINGHAM, *Application Engineer*
Minneapolis-Honeywell Regulator Co

Tube temperatures are good check on boiler operation

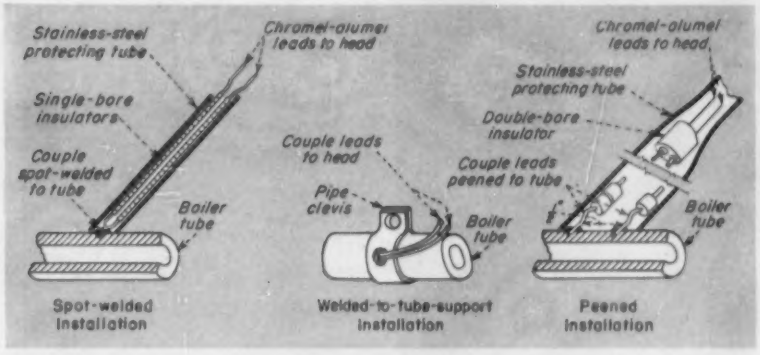
THERMOCOUPLE MEASUREMENTS of tube temperature give a valuable look into the boiler. They check on circulation through tubes, tell how well soot blowers are operating and can improve firing efficiency. During startup, temperature data show when water has boiled out, locate tube restrictions and plainly indicate excessive carryover from drums and too much moisture in desuperheaters.

A good thermocouple installation with high-speed scanning can read one temperature per second. Hot tubes are spotted immediately. Strip charts automatically record temperature as well as actuating alarms when temperature limits are exceeded.

L W FITZPATRICK *Jefferson City, Mo.*

our readers may be your problem too

HOWARD KALLEN, *Assistant Editor*



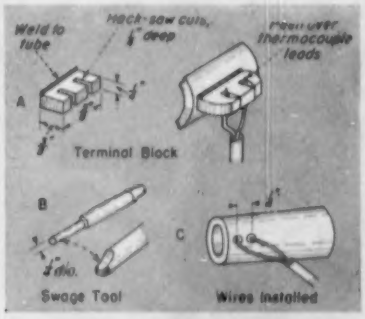
How to install thermocouples

BARE WIRES are used for getting boiler tube temperatures, with the measuring hot junction attached by any of the methods shown in the sketch above. Wires of the couple are then insulated separately and connected to a centrally mounted instrument. Wires from the hot junction to the outside of the boiler should be protected from the surrounding gas atmosphere. The sulfur in the flue gas would quickly corrode the wires if they were left unprotected.

LO should install couples in tube banks of the waterwalls, superheater, saturated-steam section and economizer. During operation, the couples will show up a heat-distribution pattern. An excessively high temperature in a group of couples would indicate that a tube or tubes had become slagged or scaled.

Continuous temperature recorders can improve firing methods by careful recorder-chart analysis. Also, thermocouples and hot junctions should be inspected during boiler maintenance outages to make sure they are OK for continued service.

A J BREUGELMANS *New York, N.Y.*



Measure temperatures at these points

SUGGESTED LOCATIONS for temperature measurements are (1) feedwater inlet to boiler drum (2) top of drum (3) horizontal center line of drum (4) below drum-water level (5) saturated steam tubes (6) superheater tubes.

Sketch above shows two ways of taking tube temperatures used in our plant. Terminal block shown in *A* is made of cold-rolled steel. In *B* and *C* pipe is drilled to diameter of thermocouple wire used, to about 1/16-in. depth. Wire is inserted, holes swagged closed.

D V RYAN *Burbank, Calif.*

I: Data for thermocouple selection

Type	Kind of wire	Recommended temperature limits, F	Wire size, No.	Best atmosphere for thermocouple
Copper-constantan	Copper—positive constantan—negative	Minus 300 to plus 600	20	Generally of no consequence in this temp range
Chromel-constantan	Chromel—positive constantan—negative	0 to 1000	14	Oxidizing or neutral
Iron-constantan	Iron—positive constantan—negative	0 to 1600	8	Reducing or neutral
Chromel-alumel	Chromel—positive alumel—negative	600 to 2000 (continuous) up to 2300 (intermittent)	8	Oxidizing or neutral
Platinum-rhodium	10% rhodium, 90% platinum } positive pure platinum—negative	1300 to 2700 (continuous) up to 2850 (intermittent)	24	Requires protection from atmospheres with ceramic tube
Platinum-rhodium	13% rhodium, 87% platinum } positive pure platinum—negative	1300 to 2700 (continuous) up to 2850 (intermittent)	24	Requires protection from atmospheres with ceramic tube

II: Data for tube protection

Type of environment	Maximum temp, F	Tube material
Slagging or corrosive	2500	Silicon carbide; inner, porcelain
Sulfur	2000	27% chromium iron
Sulfur dioxide	2200	Inconel
Hydrogen sulfide	1000	Inconel
Steam	2000	Inconel
Gas-generating units	—	Inconel

Here are data on couple protection, materials, instruments

SINCE *LO* doesn't indicate fuels burned and estimated gas temperatures, table I tabulates thermocouple materials for a wide range of temperatures and atmospheres. Table II is used to specify protecting tube materials.

For tube-temperature measurements to be of real value they should be taken at enough points to get a complete temperature-distribution picture in the boiler. To do this job, measuring instrument should accommodate a large number of primary elements. One type is a multipoint, multibank type of scanner assembly with indicating lights to identify the measurement currently being made.

Switching units are usually arranged in banks of 20 thermocouples. The assembly includes switches to permit any one couple to be manually selected and continuously measured.

H B WAYNE *Brooklyn, New York*

(*Continued on page 224*)

Another PLANT PROBLEM solved by readers

Begins on page 138

The question

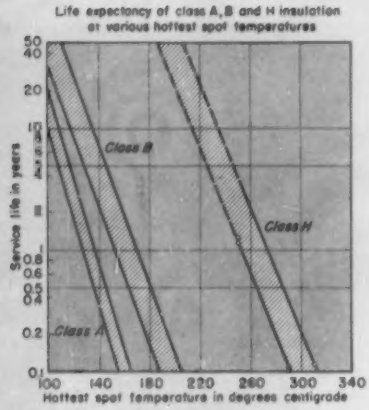
Does higher-cost insulation pay?

THE FACTS: For rewinding motors in our plant, class-H insulation has been recommended instead of class A or B. Advantages cited are longer life, greater load carrying ability, better performance in hot ambients. But quotations on rewinding costs using this material run up to 60% higher than for class A or B.

What will class H give us that A or B won't? If motors can carry greater overloads with it, what will happen to their bearings? Will they burn out? Will using more than one class of insulation lead to trouble?

—JS, Jan Power

The answers



Silicone motor insulation pays for itself, does good job under severe conditions

PERFORMANCE RECORDS from almost every type of industrial plant show that silicone (class H) insulation pays for itself. In fact, it is often less expensive than class A or B insulation.

In an Eastern foundry, for example, one motor, shown above, insulated with silicone has paid for itself 30 times by saving over $3500 in rewind costs alone. Tough operating conditions are the order of the day for this 5-hp hot-ingot conveyor motor. These conditions result from operating only a few feet from an endless procession of freshly poured ingots, jogging on a 20-second cycle and being enveloped in clouds of steam from the quenching system. Under this same setup a class-A insulated motor failed at least once a month. Rewinding with class-A insulation cost $109 and outage expenses were about the same. Three years ago it was rewound with silicone insulation at a cost of $235. The motor has not failed since. Silicone paid for itself over 30 times.

Price of motor rewinds, using class A insulation as a 100% base, ranges from about 150% for class-B insulation to 160-210% for silicone. Price spread takes into account differences in cost of components. There is also added labor involved in rewinding a motor with class B or class H.

Life expectancy curves, above, right, indicate that silicone-insulated motors, generators, transformers, solenoids, etc, have as much as 100 times the life expectancy of comparable machines with class-B insulation.

Heat stability of silicone insulation has been recognized by the hottest-spot temperature rating, 180 C, assigned to class H by the American Institute of Electrical Engineers. Actual performance of thousands of class-H motors confirms this judgment.

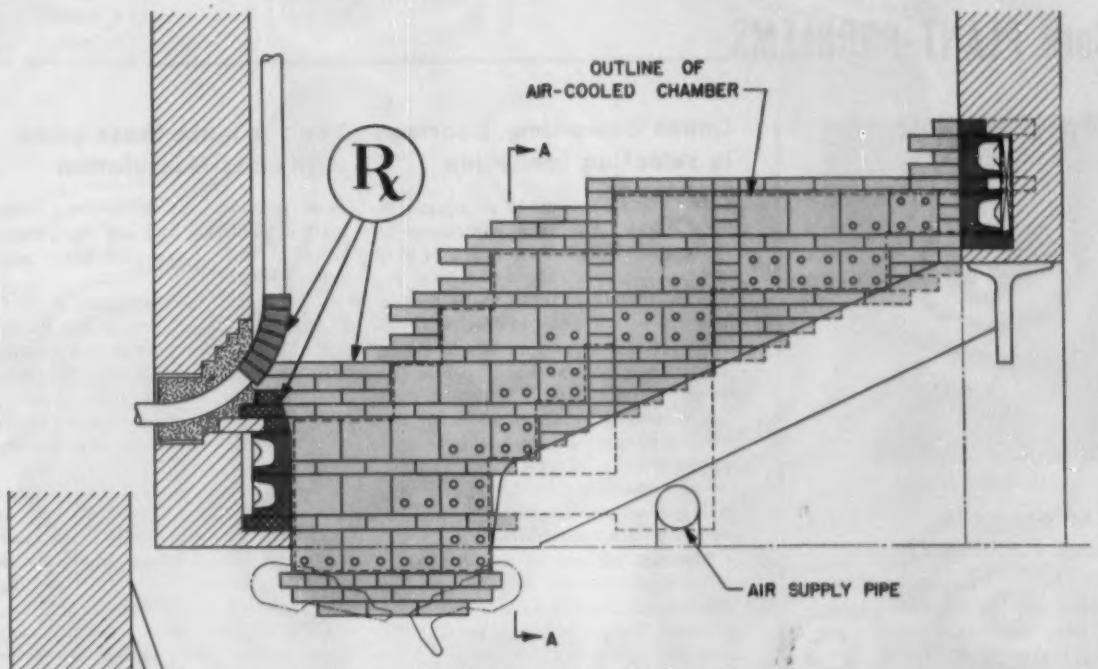
Experience gathered over the past ten years has shown that silicone insulation in the following categories is most profitable: (1) Motors operating in high ambient temperatures. (2) Critical motors—where down-time can't be tolerated. (3) Motors having heavy starting loads. (4) Motors on reversing service. (5) Motors rated for intermittent duty. Crane motors fall into this class. (6) Torque motors, since they generally have no overload protection. (7) Motors operating in corrosive atmospheres. (8) Motors operating in damp areas. (9) Motors subjected to overloads. (10) Conditions where small size and light weight are desirable.

Silicone insulation is also an economical and practical way of getting more horsepower to meet the needs of increased production schedules and stepped-up duty cycles. Standard-size electric motors rewound with silicone provide 50 to 75% more horsepower. They supply this power bonus without exceeding temperature limits for class H materials, without sacrificing efficiency and power factor and without overstressing motors' construction.

Bearings of silicone-insulated motors will be subjected to temperatures at which organic greases are unstable. But a silicone grease, Dow Corning 44, withstands this heat with a minimum of maintenance and relubrication.

L A TEICHTESEN, *Dow Corning Corp*

New questions, also more on motor insulations, p 142



In this multiple retort stoker fired boiler CRYSTOLON *engineered and prescribed* refractories provide complete air-cooled wall coverage, besides safeguarding the water tube bridge wall. A good example of how CRYSTOLON shapes may be adapted and combined for applications in many different boiler designs.

Rx *for maximum protection at vital points*

CRYSTOLON refractory shapes bring important advantages to a wide range of boiler types*

Due to careful bond selection, CRYSTOLON refractory products have a much higher useful temperature range than conventional refractories, with greater resistance to slag penetration and fly-ash accumulation. With this high refractoriness they combine exceptional hot strength, thermal conductivity and resistance to spalling and abrasion. These valuable properties show how expertly they are *engineered* to assure maximum protection against chemical and mechanical attacks by different types of fuels — and why they are *prescribed* for more efficient, lower cost boiler operation on a wide variety of applications.

This booklet tells you

how Norton *engineered and prescribed* refractories may provide the Rx's you need for better, more economical boiler performance. For your copy of *Refractories for Heat and Power*, write to NORTON COMPANY, 443 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co. Ltd., Toronto, Canada.

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REFRACTORIES

Engineered... Rx... Prescribed

Making better products... to make your products better

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More PLANT PROBLEMS

Begins on page 138

Julien Breugelmans

Who answers Plant Problems?

With Julien Breugelmans, answering plant problems is a habit of long standing. And we're mighty glad of it. Julien's answers can be spotted by their complete and careful analyses.

A graduate mechanical engineer of New York University, class of '48, Breugelmans went to work for the American Gas & Electric Service Corp where his experience in design of central-station piping systems soon put him in line for added responsibilities.

Julien's latest assignment: Equipment purchase and materials selection for the superpressure steam-turbine generator at the Philo Plant of The Ohio Power Co.

Check down-time, bearings in selecting insulation

TEMPERATURE INCREASES as square of the current. Also, life expectancy is approximately halved for each 8 to 10 C temperature rise. Thus, a critical review of operating conditions is needed before selecting motor insulation.

Operating temperature is defined as temperature at the hottest spot in the motor—usually 10 to 15 C greater than that measured by thermometer at the winding or core. So *JS* should consider not only material and labor expense but also cost of lost production because of down-time resulting from inadequate motor-insulation materials.

Bearings are one of the few motor parts subject to wear. And their careful selection and regular maintenance is important. Sleeve bearings need more attention than ball and roller bearings, but are recommended for motor sizes 200 hp and up—especially for speeds above 1000 rpm. For extreme temperature and loading conditions silicone lubrication may be *JS's* best bet for minimum bearing trouble.

When using two different grades of insulation, lower grade should be limited to allow the combination to be considered the better material's equal. If class-A insulation is used in small amounts with class B, combined materials may be considered class B if electrical and mechanical properties aren't impaired by using them at temperatures specified for class-B insulation.

H B WAYNE *Brooklyn, N. Y.*

You can make these gains with class-H insulation

SOMETHING we just don't get in a motor is 100% efficiency. And lost power that's given off as heat can play havoc with motor's insulation.

Class-B insulation operates at 25 C higher than class-A, but it has limitations because of synthetic and natural varnishes used. Silicone class-H insulation tops 200-C safe operating temperature—about three times the safe class-A temperature. This allows us to up-rate the motor.

Five-hp motor rewound with silicones can pull 7½ hp at 150 C or 9 hp at 220 C—an 80% power gain in the same size motor frame. Also, rewinding with silicones is much cheaper than installing larger motors.

Underloaded motors operate at a poor power factor. Using larger motors for temporary overloads means your motors operate most of the time at 50 to 75% load and at a poor power factor.

Silicone makers have special greases for silicone-wound motors. To avoid mixing regular grease with silicone types, replace regular grease fittings with a fitting that mates only with silicone-filled grease gun.

Lead wires from starter and switch box should be checked. With silicone windings and up-rated power, you draw more current. Use silicone tapes instead of regular electrical tapes.

L W FITZPATRICK
Jefferson City, Mo.

(*Continued on page 224*)

YOUR APRIL PROBLEMS

1 How can we estimate thermal stresses in steam lines?

In modernizing our industrial power plant, we're going to install two high-pressure boilers. Rating of each is 200,000 lb per hr at 1050 psig, 875 F. Main steam header is 10 in. diameter, feeds a noncondensing turbine-generator, pressure-reducing stations and takeoffs for process steam. We've tentatively decided on a single-header design, with bypasses on all block valves. But we want to make sure the header has enough flexibility to keep thermal stresses low.

Preliminary layout calls for a U-type expansion loop. How can we make sure its proportions and size are adequate? Where should we locate anchors to get best results? Naturally we want the thrust on the turbine inlet within allowable limits. Do *Power* readers know of any short-cut figuring methods? What judgment factors are involved?—*RT*

2 What are good forms for maintenance check sheets?

As plant-services manager in a medium-sized canning plant, I'm responsible for a wide variety of power-service equipment—pumps, motors, air compressors, air-conditioning and refrigeration machinery, to mention a few of the main items. I've permitted production-department supervisors to handle maintenance as they see fit. Results to date, as judged by maintenance costs and outages, are not good. So I've decided to start a centrally supervised program.

Although I've mentioned several types of equipment, I believe the general form of maintenance check sheets for them can be similar. I'd like them to cover frequency of inspection as well as specific items, such as lubrication, functioning, etc. Do *Power* readers have sample forms that would help me? Am mainly interested in good ideas.—*AG*

Send your answers to Plant Problems Editor. Extra pay for photos, sketches.

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In our continuing efforts to engineer sound water conditioning for industry, our service activities extend into many phases of this exacting field.

The Betz Consulting Division, for example, is typical of the completeness and diversification of the service we offer.

This separate unit of the organization, staffed with qualified chemical, mechanical and sanitary engineers, provides full-scale engineering services on a variety of problems relating to the *external* conditioning of industrial water for process, cooling, and boiler feed requirements, and the treatment of industrial waste and sewage.

Whether the water or waste problem is of broad or limited scope, the Betz Consulting Division matches *service* to *need* through its many activities such as

. . . economic and technical surveys . . . chemical engineering research . . . pilot plant design and operation . . . equipment specification and procurement . . . process design and supervision . . . start up operation . . . continuous supervisory service.

This specialized consulting service is *another* reason why Betz continues its leadership in providing completely-integrated engineering on all water problems.

Ask a Betz District Engineer the next time he calls how Betz Consulting Service can help you solve *your* water problem. He'll be happy to provide the details.

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CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

ARGUMENTS . . . *pros and cons from readers' letters*

ALTHEA THORNTON, *Assistant Editor*

Comments on license requirements

The question that was raised in December Arguments, "Why such different license requirements?" seems to be a very glaring default of all our local insurance and state officials. The situation is deplorable and unhealthy.

Apparently we are faced with a slowly but steadily rising menace in the shape of unqualified power operators and unsafe equipment. Granted, the equipment has more than enough safety devices; but any apparatus is only as good as the operator.

As soon as possible, I would like to see a meeting of qualified representatives from each state, large insurance company and major manufacturer, to accomplish the following:

1. Uniform license requirements for all types of equipment. A license would be good in any state, just like a Coast Guard marine license.

2. Uniform safety and operation instructions for all equipment.

Leading building inspectors should be included at the meeting. The group should meet biannually thereafter to make necessary revisions.

I believe such a setup would eliminate much malignant inefficiency. The problem is certainly urgent enough. Inviting national or Federal law enforcement would help get the needed uniformity.

J E SCHIRMER *USS Northampton*

A national licensing board having uniform rules and regulations enforced in all states is the logical answer to the discrepancies in licensing stationary engineers (December Arguments). The board should function like the Interstate Commerce Commission, Maritime Commission and Coast Guard.

Board members should be taken from insurance underwriters, private industry employing stationary engineers, licensing personnel from states that now have license requirements, former members of the U.S. Navy, Maritime Commission and Coast Guard.

A candidate for a license would have to meet the qualifications of the national board, regardless of his education and experience. Once licensed, an engineer could operate in any state without taking an exam every time he relocated.

In addition, uniform requirements would let insurance underwriters grant certificates of approval in a minimum of time, since they would not have to check the experience of each operator.

H B WAYNE *Brooklyn, N. Y.*

(*More comments on license requirements*, p 228)

Danger! Watch out for commutator sparks

I HAD A CLOSE CALL using a paint mixer like the one suggested in December, p 144. About 25 years ago, I made up a similar rig to do this kind of a job; it worked fine. But a spark from the motor commutator ignited volatile gases from the paint solvent, and blew the entire contents over me in a flaming spray. It burned me and set the shop on fire.

Quick action prevented more dangerous or extensive burns than I received, and put out the fire in the shop before it got out of hand.

I do not recommend such a rig for paint mixing and would not permit anyone working under me to use one.

HOWARD BENHAM *Cleveland, Ohio*

Marmy sees red

Where did this guy Surfaceblow get all his sea-going experience—on a double-ended ferry? My high regard for Our Hero really suffered when I read ". . . the Admiral's ears started turning *red* as two *starboard* running lights . . ." ("Marmy unfouls the *USS Lejeune*," Feb 1955).

ART HARRIS *Detroit, Mich.*

Marmy's sea stories are always interesting, often informative and sometimes factual. But the *fact* that starboard running lights are red has not as yet reached us here. Even the U.S.C.G. is uninformed. Could Marmy fly to Washington and straighten this out?

W H MCKINNEY *Arlington, Va.*

Poor old General Lejeune! I knew him personally—a fine Marine officer. But I'm afraid he'd lift his safety valves if he saw Marmy's bust. (Feb, p 198.)

I've been going to sea since I was ten years old. But I have yet to see a *red* starboard running light.

H M NEUHAUS *Elkins Park, Pa.*

Even an engineer should know starboard lights are green, port ones red.

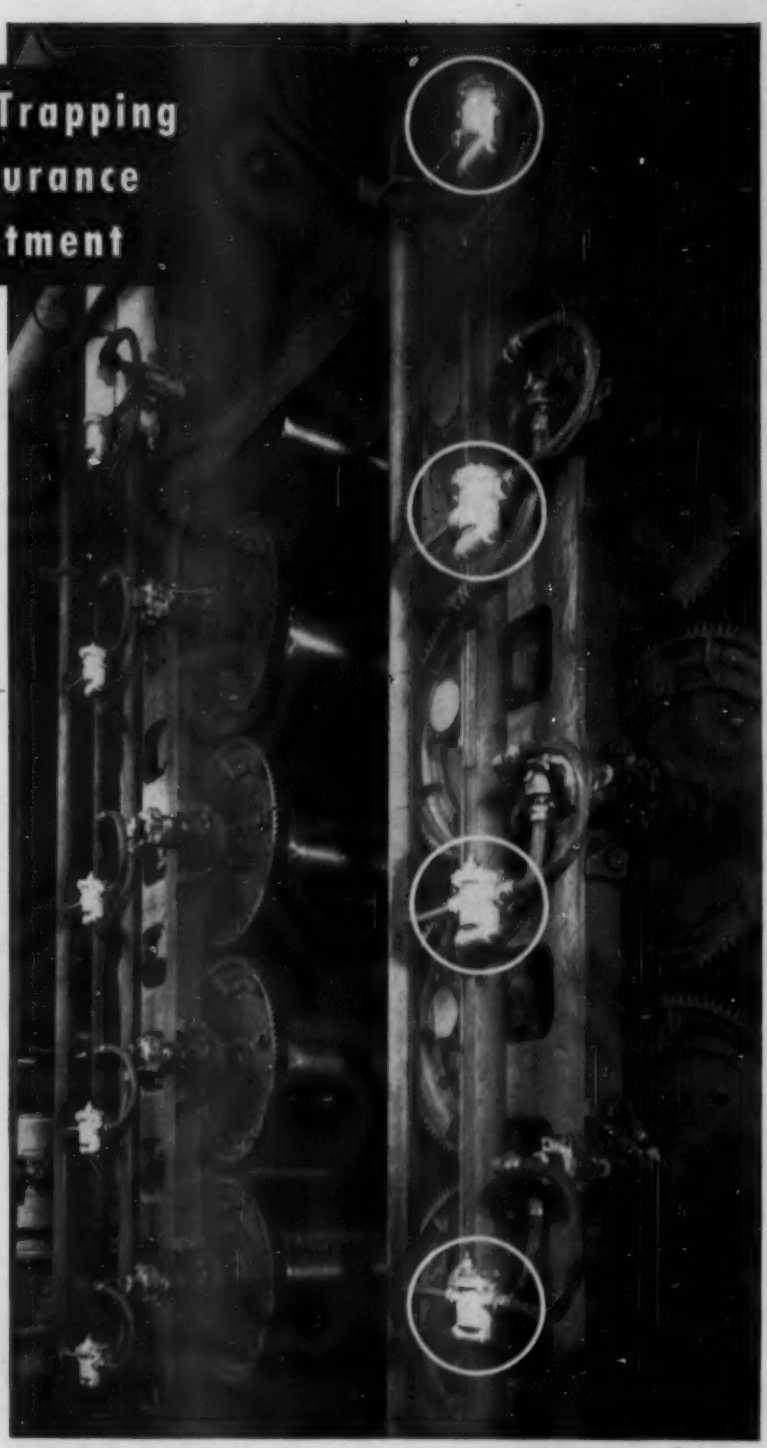
E R LLOYD *New York, N. Y.*

Hot bearing may have been due to red starboard running lights.

R G WATT *Honolulu, T. H.*

EDITOR'S NOTE: *We hate to say this, but it was probably the effect of drinking coffee that twisted Marmy's color perception momentarily. Of course, the starboard running lights are green.*

Armstrong Unit Trapping —Low Cost Insurance of a Big Investment



● *30% more production from kettles . . . 84 degrees higher dryer temperatures . . . 8% more output from dry kiln*—these are typical results of unit trapping with Armstrongs.

What about your plant? It doesn't make good business sense to spend $500, $5000 or $50,000 for equipment and then lose 10% to 30% or more of its productivity for lack of proper trapping.

Armstrong traps are "application engineered" by men who know trapping thoroughly—how to size traps for fast heat-up and top temperatures . . . correct installation practice . . . steam supply and return line requirements . . . variable pressure problems . . . mysterious difficulties. The cost of retrapping with Armstrongs is usually but a fraction of 1% of the cost of the equipment drained—*low cost insurance of a big investment!*

Call your Armstrong Representative today. He sells on a basis of "satisfaction or your money back." Or, write:

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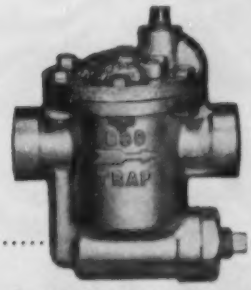


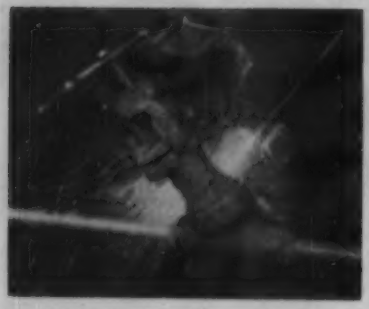
Armstrong built-in strainer traps, pictured on textile dry cans at the right, cost less to buy and install than standard traps and separate strainers—they reduce maintenance and costly shutdowns. Three sizes, ½" or ¾" connections.

SEND FOR FREE STEAM TRAP BOOK . . .

. . . 44 pages of how-to-do-it data. Useful and educational. Free on request without obligation.

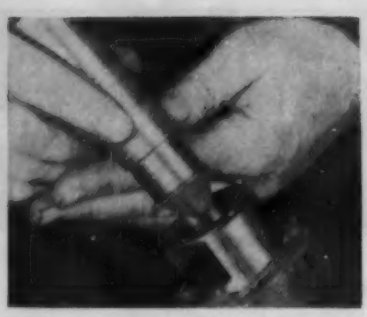
S45

ARMSTRONG STEAM TRAPS



1 Cut seal-weld with special gas torch or carbon arc using compressed air

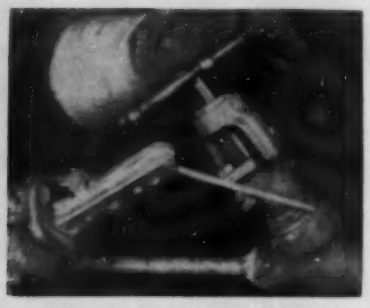
2 Bonnet joint threads in body are unharmed, now recondition the seat



3 Insert the guide bushing, then attach abrasive disk to the disk driver shown

4 Grind all the visible irregularities out of seat with a small electric drill

5 Lap with cast-iron lap on end of the stem, then with the valve disk as here



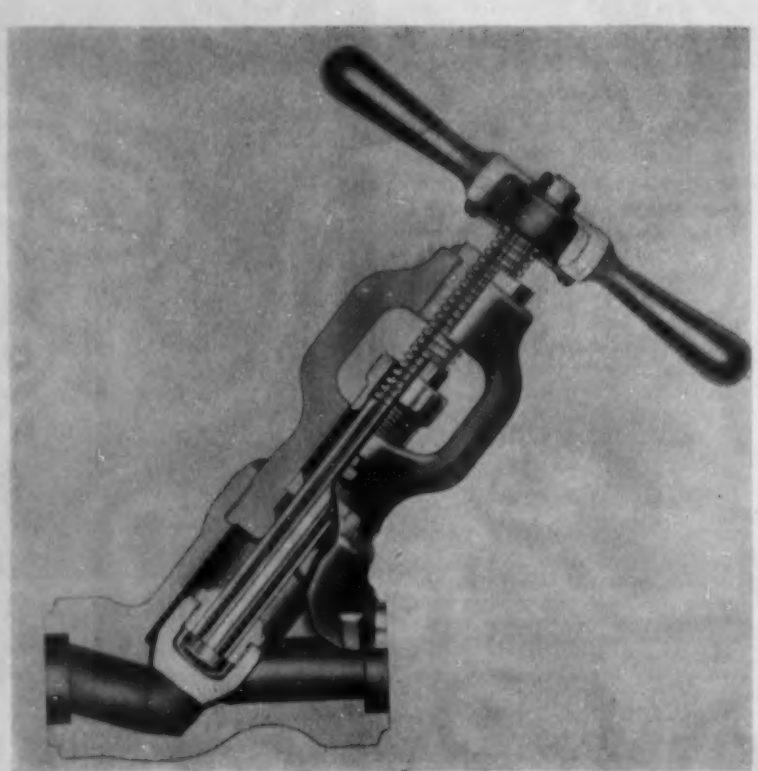
6 Reassemble valve bonnet, then re-weld. Complete job is 30 minutes

HOW TO

repair welded bonnet valves

► HIGH PRESSURES and temperatures are changing maintenance techniques. This forged-steel valve is welded closed, then burned open for valve seat and disk maintenance. A look at photos shows that job can be done by a skillful mechanic as easily as repairing bolted bonnet design. As valves are called on for tougher and tougher service, many old maintenance practices will have to be forgotten, new ones learned.

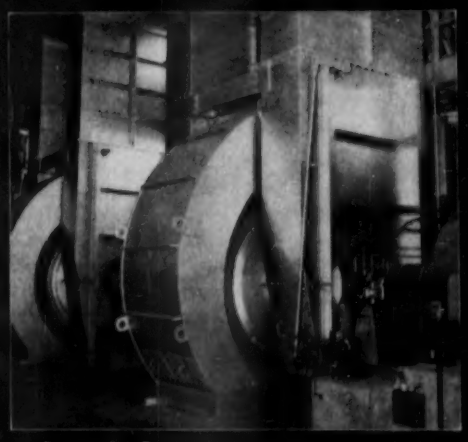
Courtesy: Edward Valves, Inc.



SEAL-WELD JOINT can also be cut with oxyacetylene scarfing torch. Use size No. 12, gouging tip to start puddle, and blow the metal away progressively, around the joint

Fact:

Westinghouse 'Design 14' Compressors Engineered to Handle Any Job— 500 to 200,000 cfm at Pressures up to 110" w.g. (4 psi)



Design 14 Compressors operate in parallel with either motor or turbine drive.

WIDE RANGE OF APPLICATION IN POWER GENERATION AND INDUSTRY

Here is a line of centrifugal compressors for wide application.

In the power field, they provide economical forced draft for pressurized and cyclone furnaces.

Industrial uses include such varied applications as combustion, catalyst conveying, scavenging, flotation, aeration of liquids and many others.

These compressors maintain constant pressure over a wide range of air output—also available with adjustable inlet Spin Control for economical part load operation.

QUIET OPERATION—

Casing proportions and streamlined wheel passages make Westinghouse Design 14 Compressors inherently quiet. Accessory sound-absorbing trunks of proved design available to reduce noise level even further where required because of location.

MORE FACTS?

Call your nearest Westinghouse-Sturtevant Sales Engineer . . . he's the "Man with the Facts" on heating, air handling, and electronic air cleaning . . . or fill in the coupon below.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S

Westinghouse

J-80414

Westinghouse Electric Corp.
Sturtevant Division, Dept. 11C
Hyde Park, Boston 36, Mass.

Please send more information on your Design 14 Compressors.

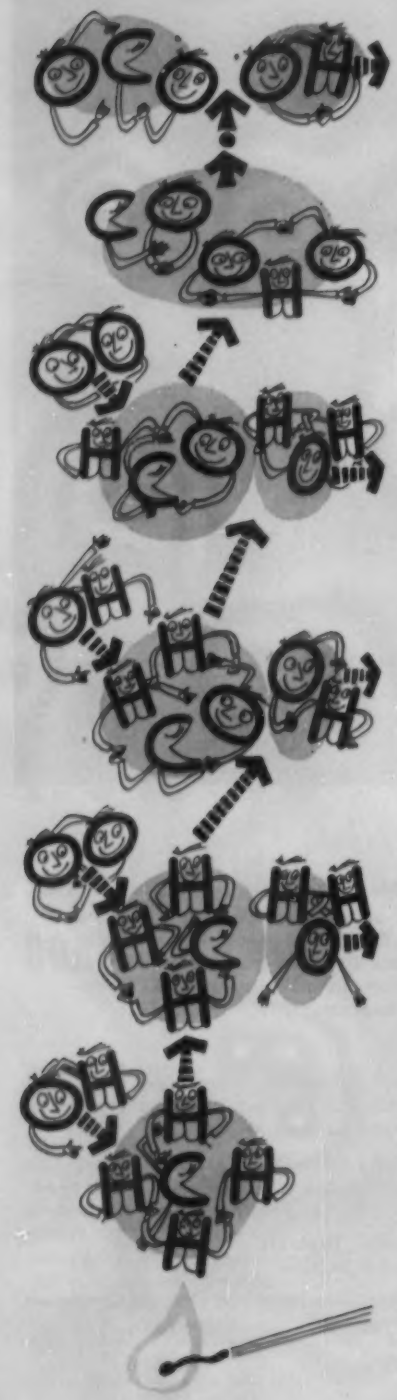
NAME AND TITLE .....

COMPANY .....

CITY .....STATE.....

BASICS . . . *bringing engineering theory down to earth*

TOD WALDRON, *Assistant Editor*



How fuels burn-4

► MIXING of fuel and air plays an important part in combustion. In actual flames and in combustion spaces we have widely different mixtures side by side. One area may have a mixture too rich to burn. This is the case in the area near the tip of a fishtail burner. Other areas may have almost all air and hardly any fuel. This unsatisfactory condition may prevail even though the average relation of fuel to air over the entire combustion space may be correct for good burning. Thorough mixing evens out these inequalities and makes the actual furnace condition more nearly like the average for the entire furnace.

Once mixing is accomplished, and enough heat is available, combustion does not take place in quite as simple a manner as might be expected. True, we start out with only two fuel elements, hydrogen and carbon. And we can show by simple equations that these fuel elements combine with oxygen to form water, carbon dioxide and, under some conditions, carbon monoxide. But what happens in between the time burning starts and the time we arrive at the final products is a great deal more complex than the simple equations indicate.

Burning of gaseous hydrocarbons is a good example of this complexity. Complete analysis of the flue gas from gas- and oil-fired furnaces often reveals presence of chemical compounds known as aldehydes. Formaldehyde is a fairly familiar member of this group. Nothing in our simple carbon-to-carbon dioxide and hydrogen-to-water reaction explains the presence of these compounds. How are the additional products accounted for?

Last month we talked about slowly heated and oxygenated hydrocarbons in blue-flame burning and the completely different process of hydrocarbons cracking under rapidly applied heat in yellow-flame burning. We can get a little closer look at the blue-flame burning process at the left. We see that the OH radical is needed at the start in the combustion of methane. Formaldehyde is the third step in the process.

Actually, not even the rather complex chain reaction shown gives the complete story. Several steps are left out between the last and the next-to-the-last products.

So we see that quite a few changes take place between the beginning and end of the burning operation and that many intermediate products form and disappear. If combustion is incomplete, some of these compounds remain and show up in the flue gas. The faint acrid odor sometimes observed indicates the presence of one group of intermediate compounds, aldehydes.

Cracking of hydrocarbons gave us yellow-flame burning in the fishtail burner. Here, instead of being oxygenated by applying heat slowly to mixture of fuel and air, hydrocarbons are heated rapidly, causing them to break down into carbon and hydrogen, which burn to carbon dioxide and water. Incandescent carbon gives the flame its characteristic yellow color, and also gives it soot-and-smoke-forming tendencies.

In practically all actual burning of hydrocarbons, both processes go on at the same time. The general character of the flame depends on which one predominates. This, in turn, depends on the surrounding conditions. Early mixing and preheating of hydrocarbons and air, plus time for oxygenation, favor blue-flame burning. Rapid heating, and lack of mixing time, tend to make yellow-flame burning predominant.

We've talked mostly about hydrocarbons so far, for two reasons: (1) Biggest part of practical combustion involves them; natural gas and oil are hydrocarbon fuels, so is the volatile matter of coal. (2) It shows clearly that while our familiar chemical equations are useful in calculating air requirements, etc, we must know more about what happens between the starting point and the finish if we are to design and operate successful firing equipment and furnaces. The actual combustion process may consist of several reactions. Their nature depends on the form in which the basic elements carbon and hydrogen appear in fuel, and the conditions under which burning takes place.

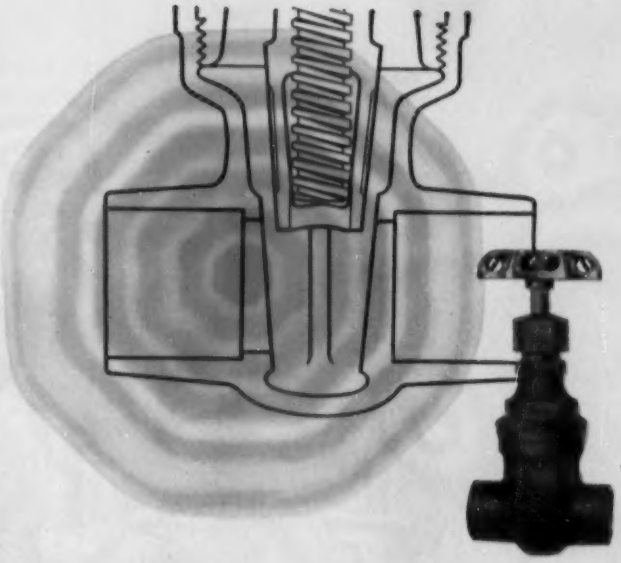
When the heat's on

you need the extra strength of

JENKINS

Solder and Socket End

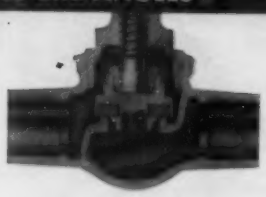
VALVES



Solder End GLOBES and ANGLES

300 lbs. O.W.G.
¼" to 3"

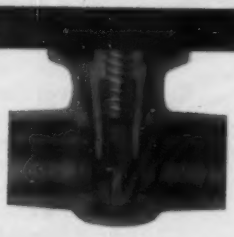
Fitted with Renewable Composition Disc.



Solder End GATES

225 lb. and 300 lb. O.W.G.
⅜" to 3"

With solid or split wedges, and stationary or traveling spindles.



Solder End CHECKS

300 lbs. O.W.G.
¼" to 3"

Regrinding. May be easily reground without removal from line.

NEW BULLETIN Lists all Jenkins Solder End and Socket End Valves and gives complete instructions for soldering and brazing. Ask for Solder-Socket End booklet.

The "light-duty" look of copper tubing installations is deceiving. Valves must provide an accurate fit to tubing and ***hold it*** under the intense heat of soldering. And, because flexible tubing does not afford the rigid support of standard pipe, valves must withstand unusual strains in operation.

Jenkins Solder End Valves are engineered to meet these demands with strength to spare. High tensile bronze castings have liberal dimensions for extra rigidity. Smooth, clean bores assure accurate fit, easy soldering, positive seal to types K, L, and M Copper Tubing.

For faster, trouble-free installation, and lasting economy, specify Jenkins Solder End Valves. Jenkins Bros., 100 Park Ave., New York 17.

JENKINS Socket End Valves

for Class B or IPS Tubing

Jenkins bronze valves with socket ends for silver-brazing are made in Globe, Gate, and Swing Check patterns to control compressed air, hot oil, and similar fluids in tubing hookups where specifications call for permanent, leakproof joints. Complete information in the Bulletin offered below.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
SINCE 1864 THAT JENKINS MARK
Jenkins Bros.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS

"You spoiled the shaft?" yelled the boss, growing pink around the gills

Marmy solves two tough problems

► "STEAM ENGINE'S new crankshaft was too small for a press fit into her flywheel, but when I got through with it they needed two tons to force her home —and we didn't have 'putting on' tools in those days," roared Marmaduke Surfaceblow, in his dingy office above O'Houlihan's Machine Shop & Engine Works. But let's start at the beginning.

The day this outburst took place the temperature was below zero here in New York City. Marmy's office was going full blast, though, and the old pot-bellied stove kept that joint warm as an old coal-burning tramp freighter's boiler room. Through the haze of tobacco smoke I could make out the old consulting engineer anchored firmly in his swivel chair. His gray bowler, checkered vest, and size-16 canal boats propped up on his battered roll-top desk told me the old boy was doing business as usual.

Amongst the assortment of waterfront characters and stationary engineers ballasting their deep tanks with coffee, I recognized an old friend. It was George Pearce from Albuquerque, New Mexico. After shaking hands with George, I grabbed myself a cup, filled it from the pot on the stove. Then I started taking on bunkers and melting the icicle from my nose.

George mentioned something about being cold enough to freeze off a brass monkey's ears—or something.

"BILGEWATER on brass monkeys," roared the cantankerous old engineer, leaning back in his swivel chair. "I'll tell you boys about the time it was cold enough to shut down a large foundry—but I saved the day." The old boy was sounding off and all eyes were on him as he blasted away. "Back in 1914 I was chief engineer on the coal collier *SS Minerva*," bellowed Marmy. "Three days out of Portsmouth, Maine, we ran into a big blow one cold day in January. In a few hours we were taking green waves over our bow. Two lifeboats on our starboard side were carried away, then another green one thundered up our forward port deck and stove in half the glass on our pilot house. The old tub labored heavily, burying her nose in mountain-high waves with every 20-degree roll.

"We slowed down to four knots to keep from breaking in two and I put my watch engineers on throttle watches. Trick was to close the throttle of the old triple-expansion engine as soon as her propeller cleared the water to keep the engine from speeding up and wrecking herself.

"After 12 hours of pumping bilges to hold our own against water seepage from popped rivets and opened seams, we ran into a whale of a headache. The hp cylinder cracked from a slug of water as the engine revvied up when our propeller lifted out of water.

"Only thing to do was to come in on two cylinders—if we could make the re-

(*Continued on page* 214)

Sound Selling vs. Smart Talk

Today, essentially, all of the chemical companies have established technical service and sales-supporting technical work. One corporation has 25 laboratories devoted to this type of work supported by 29 field laboratories. The total investment by the industry in such facilities, must run well into the tens of millions of dollars, which is one measure of how importantly the industry regards the sales function.

It is now estimated that 70% of the average chemical company's sales staff is technically trained compared with probably less than 25% only 20 years ago and an insignificant percentage 30 years ago. This current mode of selling is epitomized in the slogan of one chemical manufacturer, namely, "Serving Industry through Practical Applied Science."

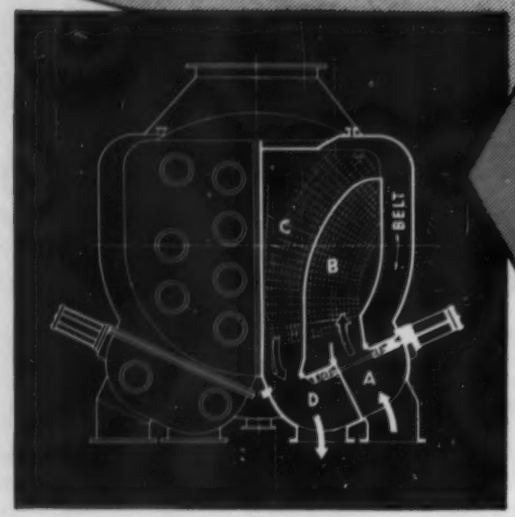
From an article: "Selling . . . Its Importance in the Chemical Industry," by J. Warren Kinsman, Vice-President, E. I. du Pont de Nemours & Co., Wilmington, Del., in Chemical Engineering Progress.

Nalco appreciates the use of its slogan, "Serving Industry through Practical Applied Science", as an example of the modern approach to chemical sales. 100% of Nalco's field service representatives are technically trained to help industry make full practical use of the chemicals and methods developed by the Nalco Laboratories: Water, Microbiological, Physical Chemistry, Organic Chemistry, Corrosion, Micrography, Metallographic, Experimental Boiler, Combustion, Oil Treatment, Paper, Ion Exchange, Weed Control, Production Control.

NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario

THE *Nalco*® SYSTEM . . . Serving Industry through Practical Applied Science

C. H. WHEELER "SELF CLEANING"
PATENTED
REVERSE FLOW STEAM CONDENSER



REVERSE FLOW

Illustrated is the C. H. Wheeler tandem arrangement in which both sluice gates operate on a single stem. In this divided water box condenser, water enters chamber A with left hand port open and flows in through pass B, out through pass C and through left hand port D. To reverse the flow, gates move to left, closing the left hand ports and opening the right hand ports of chambers A & D. Water now flows through belt, in through C and out through B and right hand port of D. The same method applies, of course, to a non-divided water box design.

No Shutdown — No Vacuum Loss for Tube Cleaning

The C. H. Wheeler Patented Reverse Flow design makes either single or divided water box steam condensers self-cleaning. These condensers are saving power plants countless hours of downtime and reduced load formerly required for manual removal of debris and organic growth from clogged tube sheets.

"Self-Cleaning" is accomplished by a set of sluice gates built integrally into C. H. Wheeler Surface Condensers which may be electrically or hydraulically operated to reverse the flow of cooling water through the tubes. This sudden flushing-in-reverse removes all debris and crustaceous matter and carries it out the discharge while carrying full load on the turbine and without reducing water flow. Also, the quick change in temperature shocks and dislodges marine growth.

Depending on condition of the cooling water, C. H. Wheeler Reverse Flow condensers have gone two years and longer before requiring cleaning. A typical field report tells of regaining a half-inch loss of vacuum (due to fouled tubes and tube sheets) five minutes after reversing the flow of condenser cooling water.

C. H. Wheeler custom - designs Reverse - Flow Condensers to suit any installation, arranging sluice gates and nozzles at top or bottom of water box and at any angle desired. Call a C. H. Wheeler representative to go over your specifications. It will mean years of substantial savings.

(BULLETIN 410 mailed on request)

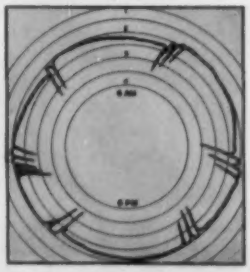
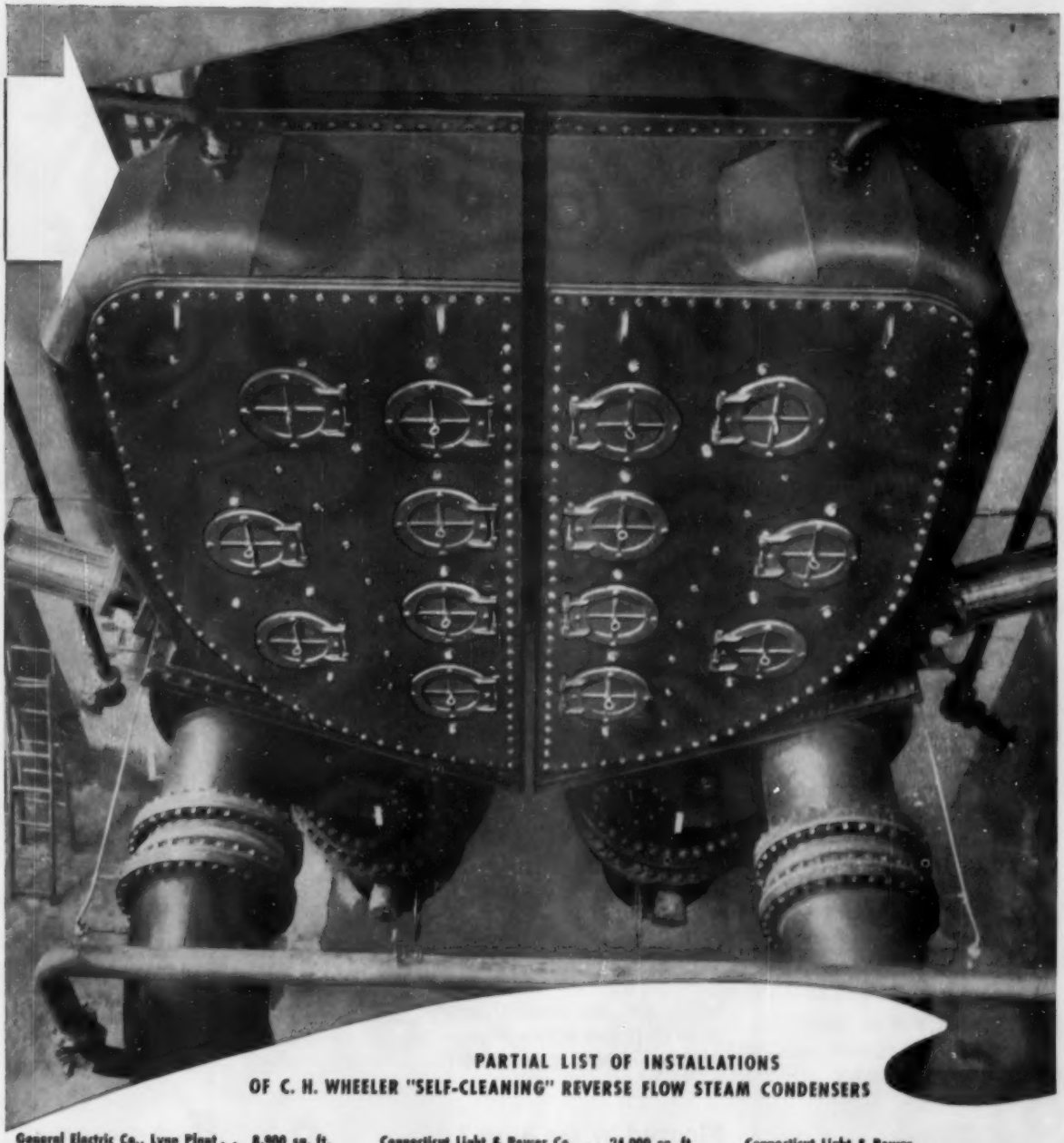


Chart shows typical cycle of vacuum and effect of reverse flow in a C. H. Wheeler Patented Self-Cleaning Reverse Flow Condenser. Note that because of 100% back flushing, the loss of vacuum during the reverse flow cycle is negligible.



PARTIAL LIST OF INSTALLATIONS
OF C. H. WHEELER "SELF-CLEANING" REVERSE FLOW STEAM CONDENSERS

General Electric Co., Lynn Plant . . 8,900 sq. ft.
General Electric Co., Lynn Plant . . 12,500 sq. ft.
Keystone Steel & Wire, Peoria . . 10,000 sq. ft.
Virginian Railways, W. Va. . . . . 15,000 sq. ft.
City of Wyandotte, Mich. . . . . 12,000 sq. ft.
City of Kansas City, Kansas. . . . 32,500 sq. ft.
New Bedford Gas & Edison Light,
New Bedford, Mass. . . . 16,500 sq. ft.
New Bedford Gas & Edison Light . 25,000 sq. ft.
Connecticut Light & Power Co.,
Montville Station . . . . . 24,000 sq. ft.
Connecticut Light & Power Co. . . 24,000 sq. ft.
Connecticut Light & Power Co.
Devon Station . . . . . 50,000 sq. ft.
Georgia Power Co., Atkinson Station, 47,000 sq. ft.
Alabama Power Co , Units 1 & 2
Gadsden Station . . . . . 47,000 sq. ft.
City of Holland, Michigan . . . . . 13,000 sq. ft.
South Carolina Electric & Gas,
Unit #1 Urquhart Station . 45,000 sq. ft.
South Carolina Electric & Gas,
Unit #2 Urquhart Station . 45,000 sq. ft.
Connecticut Light & Power,
Montville Station . . . . . 55,000 sq. ft.
Monongahela Power Company,
Albright #3 . . . . . 65,000 sq. ft.
Georgia Power Company,
Hammond Station, Units 1-2-3, 74,000 sq. ft.
City of Jacksonville, Fla.,
Southside Station . . . . . 40,000 sq. ft.
Tallyrand Station . . . . . 40,000 sq. ft.

C. H. WHEELER *of Philadelphia*

C. H. WHEELER MANUFACTURING CO., 19th & LEHIGH, PHILADELPHIA 32, PENNA.

Steam Condensers • Centrifugal, Axial and Mixed Flow Pumps • Steam Jet Ejectors • Vacuum Refrigeration
High Vacuum Process Equipment • Micro Particle Reduction Mills • Marine Condensers and Ejectors • Deck Machinery

Reader service section

Start with these quick samples . . .

Brother, that's power . . .

when it takes 25,000 hp to accelerate the rotating mass of a motor to the rated 600 rpm. The motor kicked over by this little starter is one of two 83,000-hp synchronous units, largest of their kind. Want to know what that much motor drives? See Reports from the Field . . . . . p 156

Mighty midget . . .

that's the germanium rectifier. A little bit of this scarce metal does a big job—and that's lucky because it's still expensive. To get a line on this promising newcomer in the field of power rectifiers, skim the digest in Technical Briefs, send for full report . . . . . p 158

'Keeping it under control' . . .

is made easy by a new IBM development. Using existing wiring, their central-control system switches on or off up to 40 groups of remote operations—each on its own time schedule. Facts on this and other improved products in Plant Equipment News . . . . . p 162

Good to the last drop . . .

but what then? Maintenance men, especially, will be interested in item No. 29 in the Free Literature columns. For convenience in securing this, or any other publication, use handy postcards . . . . . p 171

White elephants or work elephants . . .

which are you keeping? George Edwards, engineer-philosopher, draws some profitable advice from an expensive Siamese custom. Humor, advice, odd and interesting facts, in this month's Scrapbook . . . . . p 174

Floored by the atom? . . .

Pick yourself up with "Introduction to Atomic Physics" by Otto Oldenberg. This Harvard professor's key to understanding nuclear theory is just one of the timely works reviewed in Bookshelf . . . . . p 200

Nothing stands still . . .

least of all the power field. Typical of one month's activities: ten manufacturers announce new representatives to serve you, five open new branches. Who and where? Turn to Appointments, of course . . p 206

For other timely ideas, see following service pages ▶

SARCO electric temperature control

ACCURACY AND SENSITIVITY BY SIMPLE ELECTRICAL MEANS

"Very successful in our operation, and I specify them on all our new equipment," says Thomas Allison, Plant Engineer of Southern Gravure Service, Louisville, Ky. ***(See photo at left)***

IN HIS CASE the operation is plating, an industry in which SARCO electric controls have found wide adoption.

There are many others: For example, dryers in the textile, tanning, food and chemical industries; dyeing and wet finishing processes in textiles; processing, distilling and evaporating in chemical plants.

SARCO's complete line includes also thermostats and solenoid or motor valves for space heating, air conditioning and refrigeration control.

Get the whole story by writing for bulletins 1025 and 1080.

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EMPIRE STATE BUILDING, NEW YORK 1, N. Y.
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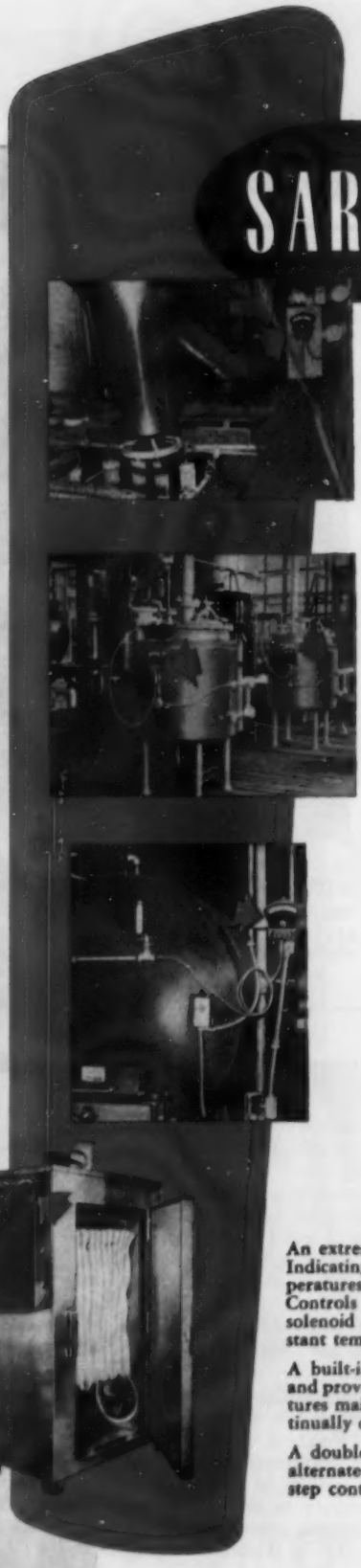
REPRESENTED IN PRINCIPAL CITIES



PLATING

In copper and chromium plating of rotogravure rolls, the temperature of plating solutions is held to within ½°F by Sarco Electric Indicating Temperature Controllers. Photo taken in Southern Gravure Service plant, Louisville, Ky.

CHEMICAL

Hoffman La Roche Pharmaceutical Co., Nutley, N. J.—the jacket water temperature of these stills must be held to within ½°F. For the past 9 years, Sarco LSI Indicating Temperature Controllers have been doing that job.

FOOD

Chocolate milk and soft drinks in bottles and cans are processed in Fort Wayne Sterilizers. Many users equip these Sterilizers with Sarco LSI Electric Indicating Controllers to hold the temperature to within ½°F. Hook-up sketches and case histories on request.

TEXTILE

The Backus Hosiery Conditioner processes 15 denier nylon hosiery—40 dozen per 1 hour cycle. The humidity and dry heat are controlled by two Sarco Electric Indicating Temperature Controllers. Over 500 LSI's have been factory-installed on these Conditioners by Backus Machine Works, Carlstadt, N. J.

TYPE LSI •

An extremely sensitive and accurate Electric Indicating Temperature Controller for temperatures from minus 90°F to plus 650°F. Controls electric heating elements, motors, solenoid or motor valves to maintain constant temperature.

A built-in thermometer makes setting easy and provides a continuous check on temperatures maintained without the bother of continually changing charts.

A double switch type L2SI is available for alternate heating and cooling control, or step control of heating or cooling.

366

REPORTS FROM THE FIELD

What's happening in power and what it means to you

For Calendar of Events see page 248

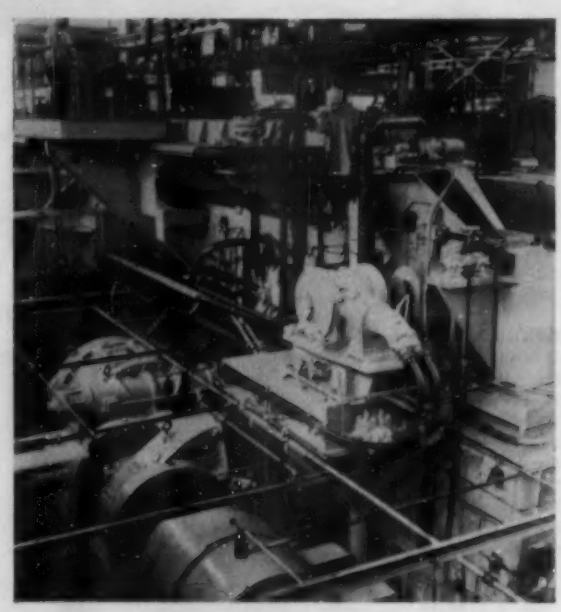
Largest oil-hydraulic pumps deliver 2300 gpm

► LARGEST HYDRAULIC PUMPS ever built are being used to operate saddle of world's biggest tube-reducing machine, under construction for Tube Reducing Corp, Wallington, N. J.

Supplied by Waterbury Tool, div of Vickers, Inc, these pumps are of axial-piston, variable-displacement, reversible angle-plate type. Two of these units together, as used on one machine, are capable of transmitting power equivalent to that of a Great Lakes freighter. The combination of precise control functions required in this application, plus rapid reversals under very heavy loading pointed to selection of a hydraulic drive. Hydraulic method of operation provides: variable stroke length; variable positioning of short stroke within range of the full stroke; means of progressively shortening stroke; and variable speed as a function of stroke length. Reversing feature of pumps eliminates necessity for separate reversing valves.

Each of the two pumps per machine is capable of delivering to 2300 gpm in either direction of flow at pressures to 3000 psi. They will operate either as a pump or hydraulic motor. Each pump has 13 cylinders using pistons with approximately 4-in. diameters.

System connections are 10-in. IPS for main system and 3-in. IPS for circulation and replenishing, in order to keep friction line losses to a minimum. Because each pump is required to stroke from 0 to 2300 gpm in ½ sec, then back to 0 in ½ sec and reverse through the same cycle, it is important to keep reversing load to a minimum. For this reason, angle plates in the pumps are mounted on a vertical axis to eliminate gravity effects on rapid stroking.



Air Force wind tunnels use 83,000-hp synchronous motors

► WORLD'S TWO MOST powerful motors were recently given their official start-up. Built by Westinghouse Electric Corp, the giant 83,000-hp synchronous machines will power the U.S. Air Force's new transonic and supersonic wind tunnels at Arnold Engineering Development Center, Tullahoma, Tenn.

The wind tunnels will be used to test and evaluate supersonic planes, full-size jet engines and guided missiles. The supersonic tunnel is designed to produce air speeds to 3800 mph.

Two 25,000-hp induction motors were used to start the synchronous motors and accelerate the rotating mass to its rated 600 rpm. Four motors will be connected in tandem to five giant compressors, one for the transonic and four for the supersonic tunnel.

Installation of the transonic compressor, built at Westinghouse Sunnyvale, Calif. plant will be completed in a few months. The four supersonic machines will be installed later.

Despite tremendous weight and speed of the motor and compressor system, it can be halted in about 3 min by using wound-rotor motors as brakes.

Included in the Air Force installation is the largest liquid rheostat of its kind in the world. Built by General Electric Co, unit is able to dissipate 3300 kw. It will be used to vary current passing into huge heaters that regulate temperature passing through test section of the wind tunnel. Weighing 40,000 lbs when full, rheostat has three pumps that each force 225 gallons of electrolyte per min. Contrary to normal practice where wye point is grounded, each phase is insulated from the other two phases. Mounting bushings insulate each phase from ground.

Power production in Russia reaches peak in 1954

► RUSSIA CLAIMS to have boosted power production to record peaks during 1954. The USSR Council of Ministers' Central Statistical Administration reports that electric energy output last year was 11% higher than in 1953. Specific power output figures were not given for 1954. However, based on claimed production of 133-billion kwhr in 1953, the 1954 production would be about 147.6-billion kwhr. While obtaining a greater percentage of increase, actual Soviet gain of 14.6-billion kwhr is far below U.S. increase for 1954.

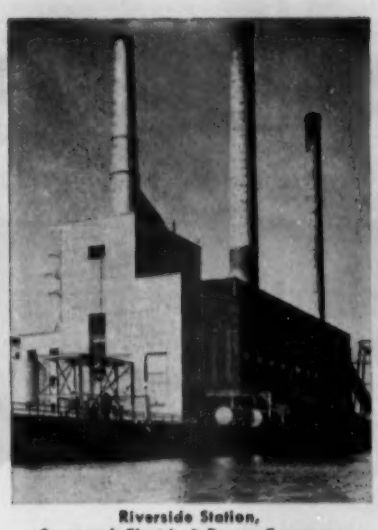
The Council reports output increases of power equipment for last year as follows: steam turbines 4%, hydraulic turbines 82%, hydrogenerators 62%, mainline steam locomotives 13%, and mainline electric locomotives 7%.

(More Power News on page 248)

Hookers Point Station, Tampa Electric Company

Possum Point Station, Virginia Electric & Power Co.

Louisiana Station, Gulf States Utilities Company



Riverside Station,
Savannah Electric & Power Company

Designed & Constructed
by
Stone & Webster
Engineering Corporation
and using

MODERN OIC VALVES

OIC Valves are *precision engineered* and *precision built*. OIC engineers offer you *precision application* help.

Venice No. 2 Plant, Union Electric Power Company

OIC
FOUNDED 1883

VALVES

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON

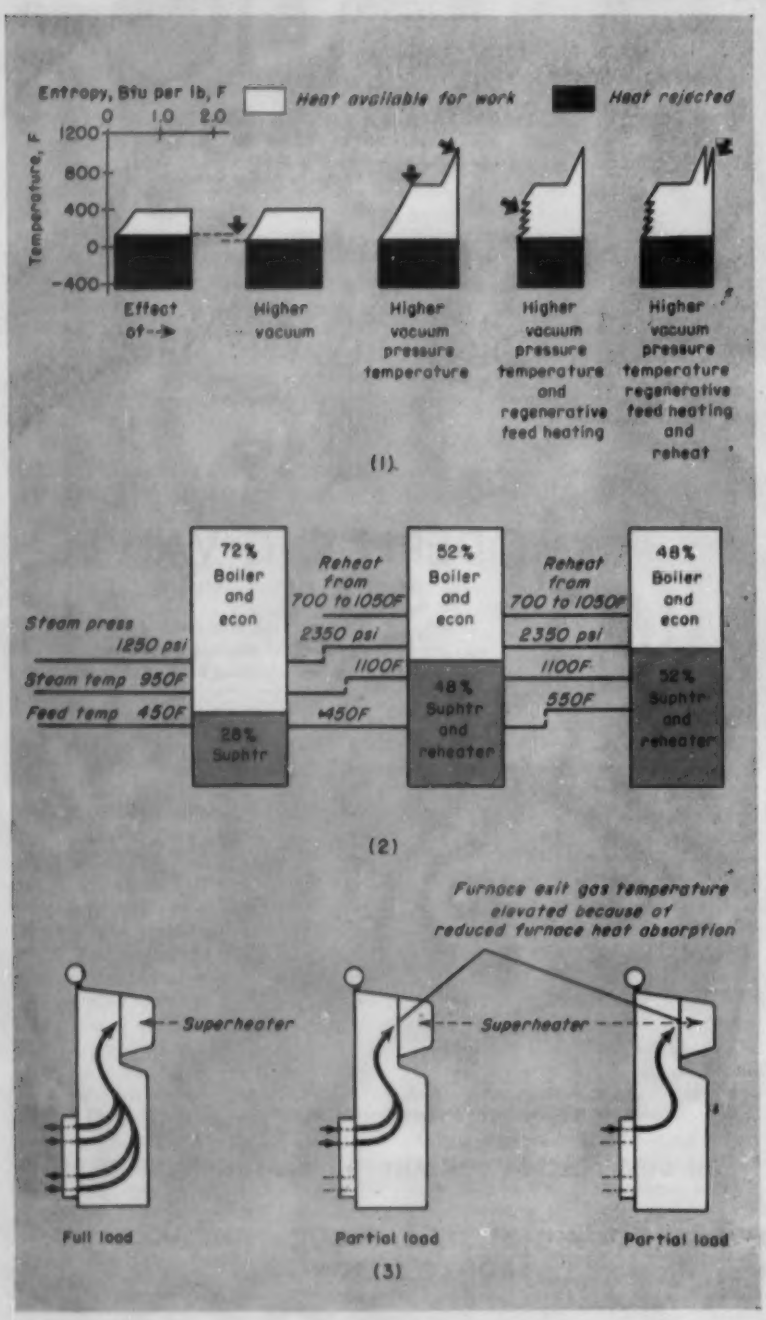
TECHNICAL BRIEFS

Latest engineering developments for busy power men

14 Digests for you on:

STEAM BOILERS
POWER RECTIFIERS
STEAM PLANTS
STEAM TURBINES

Important factors in high-temperature boiler design



Principles of boiler design for high steam temperatures. *By George W Kessler, The Babcock & Wilcox Co.*

For years, engineers have striven for better and more efficient boilers in their efforts to produce electric power at lowest possible cost. Today the best possibilities for still greater economy lie in directions other than increased boiler efficiency. These include improvements in the heat cycle, methods of firing, function operation, and in maintenance. Greatest attention is being focused on increased cycle efficiency.

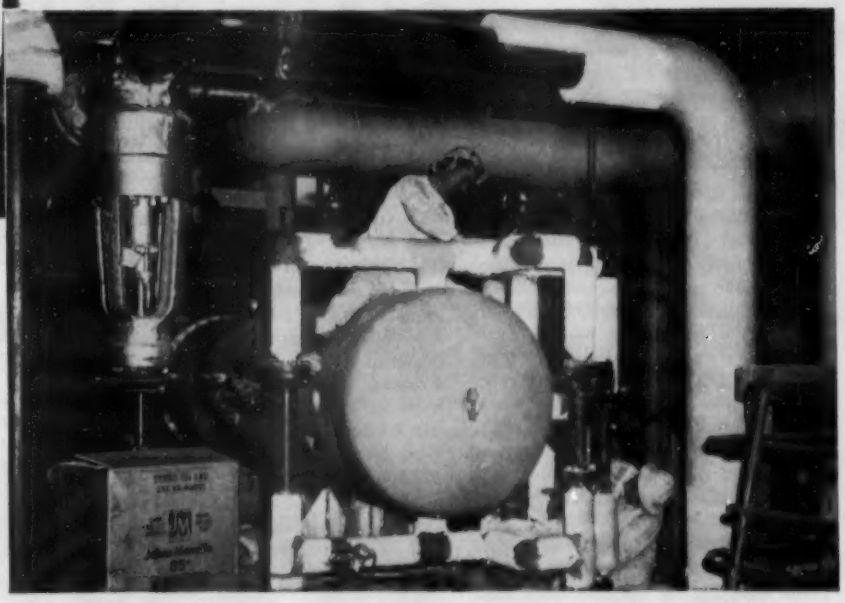
Rankine cycles for various operating conditions, Fig. 1, probably give the best idea of the path to higher cycle efficiency. Greatest improvements in cycle efficiency are obtained with optimum combinations of steam pressures and temperatures.

Improving cycle efficiency by increasing steam pressure and temperature, using regenerative feed heating, and reheating in one or more stages, appreciably affects boiler design. Boilers must not only be designed to function at these higher steam pressures and temperatures, but the greatest portion of the available heat must be transferred to the high-temperature absorbing surfaces—the superheaters and reheaters. Fig. 2 shows the influence of steam-cycle characteristics on the distribution of heat absorption in boilers.

One method of reducing furnace heat absorption and providing additional heat to superheaters and reheaters utilizes burner positioning, Fig. 3. In the simplest designs, burners are arranged singly or in groups at different furnace levels. All burners are in use at maximum load, but as load decreases, burners at the lowest level are removed from service. This continues until only the top burners are in use.

Other items discussed in this paper include interstage firing, gas recirculation, radiant superheaters and reheaters, and materials. Design problems for high steam temperatures are clearly understood and it is believed they can be resolved at costs that will justify the advance to higher steam temperatures. *ASME paper no. 54-A-233.*

At the new Moss Landing generating plant



(Top) Moss Landing, California steam plant of the Pacific Gas and Electric Company, designed by Stone and Webster Engineering Corporation, under the supervision of the P. G. and E. Engineering Dept.

(Right) Skilled applicators of an outstanding J-M Insulation Contractor, Western Asbestos Company of San Francisco, applying J-M 85% Magnesia to pipelines during construction of the Moss Landing plant.

P. G. and E. INSULATES WITH SUPEREX-85% MAGNESIA TO LOWER POWER PRODUCTION COSTS

When Pacific Gas and Electric Company invested $80,000,000 in its new 771,000-horsepower electric generating giant at Moss Landing, California...the insulation, like all other materials, had to meet rigid specifications. *For this important project, Johns-Manville Superex-85% Magnesia double-layer insulation was used on superheated steam pipes.*

Superex Combination Insulation consists of Superex*, a J-M insulation for temperatures to 1900F, and J-M 85% Magnesia. It was installed at the Moss Landing plant for maximum thermal efficiency and long trouble-free service. This double-layer construction, proved in over a quarter-century of outstanding on-the-job performance, utilizes the higher heat resistance of Superex next to the hot surface—the greater insulation value of J-M 85% Magnesia for the outer layer. It eliminates through joints, protects the jacket against scorching and is unharmed by expansion encountered in pipes carrying superheated steam.

J-M 85% Magnesia is the leading insulation for temperatures to 600F. It will not distort regardless of its length of service. It fits snug, stays tight. Heat savings, therefore, remain constant for the life of the equipment on which it is applied.

Whatever the insulation—it must be properly engineered and installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced J-M Insulation Engineers and J-M Insulation Contractors. These men stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings.

For further information, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

Double-Layer Superex-85% Magnesia Insulation was used on superheated piping at the P. G. and E. Moss Landing plant.

*Reg. U. S. Pat. Off.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

More TECHNICAL BRIEFS

Begins on page 158

Steam boilers

Continued from page 158

Operating experience with dual-circulation boilers using 100% makeup. *By Joseph R Goff and J E Harden, Whiting Refinery, Standard Oil Co.*

Selection of 1500-psi design pressure dual-circulation boilers for the Whiting, Indiana refinery was based on careful evaluation of practical and economic considerations involved.

Increased demands of immediate postwar period for both power and steam at the refinery required installation of additional facilities. Indications were that a satisfactory topping cycle must operate at not less than 1200 psi to provide a sufficient margin of power generation for the future. Studies and consultations showed that an installation up to 1500 psi could be successfully operated on 100% makeup if the right water-treating equipment and boilers were chosen.

First dual-circulation boilers, together with first units of the water-treating plant were put on the line more than 6 yrs ago. These units, and all successive ones, have operated satisfactorily.

Runs of about 12 months are normally obtained on all boilers between maintenance shutdowns. Control of boilers is as easy or easier than the original 400-psi boilers in the plant. Gross efficiency of dual-circulation boilers is maintained at from 86 to 87% while burning oil or gas. *ASME paper no. 54-A-232.*

The dual-circulation boiler in the industrial power plant. *By R A Lorenzini, Foster Wheeler Corp.*

Industrial plants, anxious to realize advantages of generating steam at high pressures and temperatures, have often been deterred from achieving this aim by unfavorable water conditions. The dual-circulation boiler is well suited for generating high-purity steam from waters once considered undesirable for high-pressure boilers. Stage evaporation in dual-circulation boilers assures maintenance of low salt concentrations in the high heat-absorbing section where most of the steam is produced. This greatly lessens danger of deposits, insuring against furnace-tube overheating.

Carryover from dual-circulation boilers is less than from units of conventional design. Boiler-water concentrations well above generally accepted limits can safely be maintained in low heat-absorbing sections without reducing steam purity. This reduces blowdown, saving on chemical-treatment and pumping costs.

With dual-circulation boilers it is usually possible to use less expensive water treatment because complete removal of silica and other constituents of raw water is unnecessary. *ASME paper no. 54-A-214.*

Four years stationary operation of marine boilers. *By J H Colby, Diamond Alkali Company.*

In the post World War II (1947-1950) expansion, four Babcock & Wilcox oil-fired divided-furnace boilers, originally designed for U.S. Navy *class 692* destroyers, were purchased to meet the need for steam in the Texas division of The Champion Paper and Fibre Co. In Navy Service these boilers were rated 122,500 lb per hr at 565 psi and 850 F.

When installed on land they were rerated for 350-psi drum pressure, 310-psi and 750-F superheater-outlet conditions. Necessary relief-valve changes were made. With a superheater pressure drop of 40 psi, rerated maximum steam flow is about 65,000 lb per hr. The boilers use natural gas, and are under automatic control at all times. They are the most efficient this company is presently operating. Load changes from 10,000 to 55,000 lb per hr are handled with a superheater outlet temperature change of only ± 5 F.

Utilized 70% of the time, the boilers have been available 98% of the time. Steam cost for the past year has been 28.5¢ per 1000 lb. Labor and supervision is only 3% of steam cost; maintenance about 1%. Remaining 24% represents power, depreciation, taxes and overhead.

One important factor leading to continued operation is proper boiler-water conditioning and control. *ASME paper no. 54-A-219.*

Power rectifiers

Application of germanium power rectifiers. *By R M Crenshaw, General Electric Co.*

For many years the well-known copper-oxide and selenium rectifiers have been important where d-c power is needed in moderate quantities for industrial plants. Now the germanium power rectifier takes its place beside the others and promises to replace them in many applications.

First look at this new rectifier is startling because of its small physical size compared to other metallic rectifiers. Though not plentiful, and high in cost, only a small quantity of the metal is needed to do a large rectifying job.

Ratio of forward to reverse resistance is in the order of 1- to 400,000 at the area of optimum rating. This far exceeds ratio of other metallic rectifiers. Germanium cell is operated at a current density almost 1000 times greater than copper oxide. Though small size offers a number of advantages, it also introduces a few problems—mainly in ability to make physical connections that will handle relatively large currents. Another problem is that of effectively removing heat generated in this very small device. *AIEE paper no. 55-138.*

Safety experience and practice in the operation of mercury-arc rectifiers in an aluminum plant. *By James B Pitman and Robert N Wagner, Aluminum Company of America, Pittsburgh, Pa.*

This paper discusses rectifier installations at the Massena, N. Y. works of the Aluminum Company of America. The plant has been in operation more than 50 years, combining smelting and fabricating facilities. D-c generators, driven by hydraulic turbines, first produced electrolytic power. Later, when need for more power arose, a large rotary-converter station was built. Both these installations are still operating at full capacity.

In 1937 and 1942, rectifier stations were built, the first containing 12 multianode and 4 ignition-type rectifiers. Second has 34 ignitrons.

An elaborate safety organization and program has produced an enviable record—only two lost-time injuries in over half a million man hours since 1937. The paper describes in some detail the safety organization and program, hazards and protective measures, typical accidents and the record of results achieved. In view of hazards involved, the safety program in this plant has achieved excellent results. *AIEE CP, no number.*

Latest operating experience on mechanical rectifiers. *By K McCaskill, Hooker Electrochemical Company, Niagara Falls, New York.*

The mechanical rectifier is an important item of equipment in this company's three chlorine plants since it supplies about 30% of the d-c load for electrolytic cell lines. Required rectifier characteristics for this service include high

(Continued on page 238)

Directions for ordering papers on p 246

You get MORE CAPACITY with a FANMIX BURNER

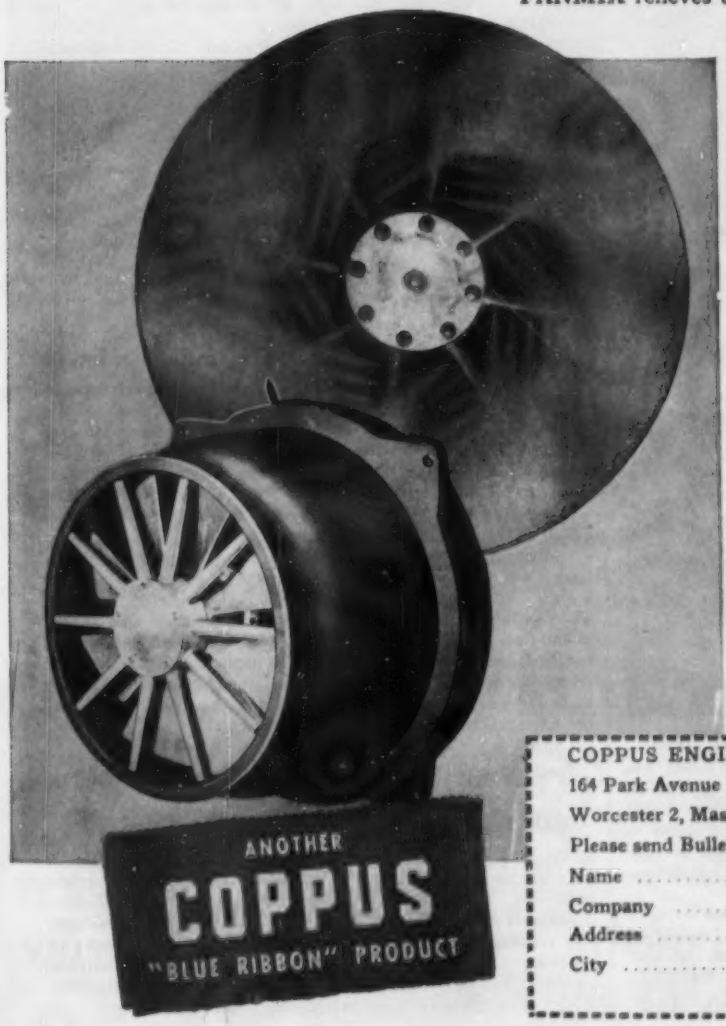
Increase Boiler Ratings On Present Or Planned Equipment

In all types of Coppus-Dennis FANMIX Burners — straight gas or combination gas-oil — we utilize the energy of the fuel under pressure to drive the burner fan and deliver air in the proper proportion to the fuel flow. This exclusive "pinwheel action" *mechanically* mixes fuel and air in exactly the right proportions for truly radiant, non-luminous heat.

The result is uniform temperature everywhere in the combustion chamber — no drifting "hot spots" — and complete combustion under all conditions. That's why you can release more heat into your present furnace — why in new installations you get more heat into smaller furnace space.

FANMIX Saves On Both Old and New Installations

FANMIX can easily be operated with your present furnace and stack, requiring only minor changes in other equipment. Or if you're planning on new boilers, remember that FANMIX relieves the furnace from the burden of mixing, creates its own forced draft and takes smaller pipe sizes. Which means you can plan on reduced combustion space, less stack, no forced draft equipment and lower installation costs all around.



Get the Whole Story

Coppus engineers FANMIX Burners to meet individual requirements, providing complete control over heat pattern and combustion . . . Learn more about how "pinwheel action" can step up *your* boiler performance to peak efficiency and economy — as it is doing throughout industry. Send for Bulletin 410-6. Coppus Engineering Corp., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG, and MINING CATALOGS.

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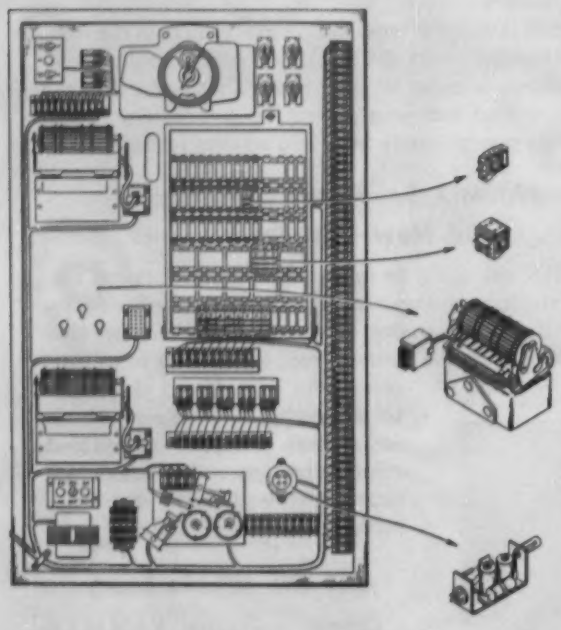


Central-control system uses existing wiring to regulate 40 groups of remote operations

428 • "Electronic supervisor" automatically switches on or off up to 40 groups of remote operations—each on its own time schedule. Operations include: switching lights on and off, starting and stopping motors, opening and closing valves, controlling air conditioning, operating on and off processing controls.

Central-control system uses carrier-current signals sent over existing wiring. No new transmission wiring need be installed. Indicator lights on panel show state of remotely controlled service. In addition to following preset programs automatically, changes in operation can be made manually at control panel or at remotely-controlled relay as needed.

Basic system components include: central operations panel, transmitter, and coded relays. Central operations panel has rotating program machine that can make minute-interval operations for an entire week. Program sequence can be easily changed by substituting bars in drum of program machine. Signals originated by program machine are sent by electronic transmitter over existing 60-cycle wiring to coded relays controlling the switches to be operated. Coded relays reject all signal pulses except those they are preset to act upon.

A control system may be easily expanded to accommodate additional programming units, circuits and relays. Further information available on request to the manufacturer.

International Business Machines Corporation, 590 Madison Avenue, New York 22, New York

For more data on these items, use post cards p 171. Identify your request with item number.

Saybolt viscosimeter has thermostated bath

429 • Unit, with suitable combination of viscosity tubes, can be used to make either Furol (fuel and road oils) or Saybolt Universal viscosity measurements. It is designed to meet ASTM specifications. Key to reliability is claimed to be its ability to hold oil samples within .02 F at temperatures ranging between 60 and 220 F. This is achieved with a completely new thermostated bath encasing the standard Saybolt tubes.

The bath is made of 18:8 corrosion-resistant stainless steel. A drain-overflow holds level of bath liquid at prescribed height on the Saybolt tubes. Bath can be drained through external connections. Unit may be operated at temperatures to 250 F.

Fisher Scientific Co, 717 Forbes St, Pittsburgh 19, Pa.

Low-reactance busway system features safety

430 • Flexibility, safety and performance are claimed features of *Uni-Bus* busway system. Only capacity that is required for original installation need be installed. As loads increase additional runs can be paralleled to original installation because of matched impedance and consequential load balancing of system. Additional runs can be either feeder or plug-in type. They can be installed without disturbing any existing taps or connections. No special adapters are required.

Outstanding features, according to manufacturer, are: both feeder and plug-in types are low-reactance designs; plugs are designed so entire interior is dead and disconnected from bus when switch is in an open position and circuit cannot be broken at the bus; opening to bus housing must be closed before plug can be inserted or removed; method of contact to bus is designed so plating on bus is not abraded; full taping eliminates danger of power arcs; flexible connections eliminate special fittings and need for precisely accurate installation drawings.

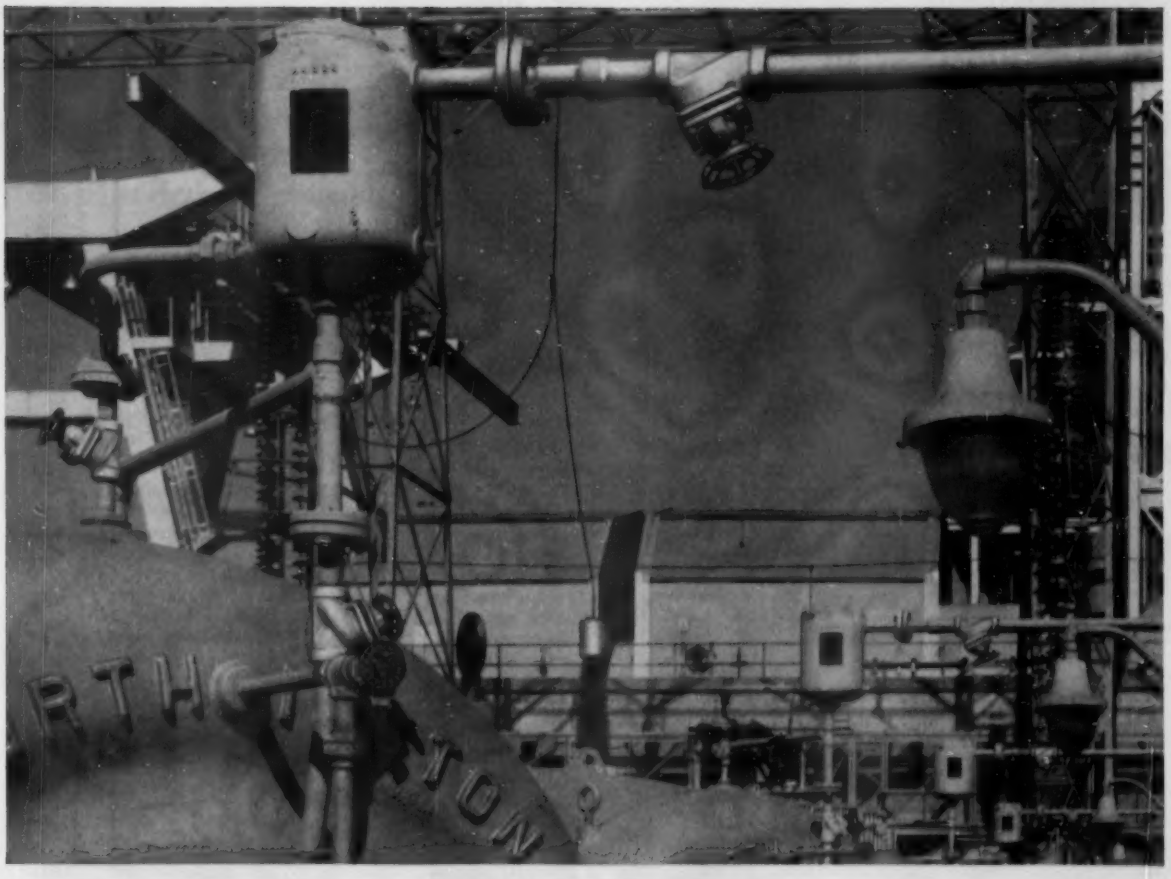
Capacities are 225 amps and up, 600 v, 2, 3 and 4 pole.

Roller-Smith Corporation, Bethlehem, Pennsylvania

Cable constructed for hot locations to 200 C

331 • *Okotherm-insulated* aluminum-sheathed cable is designed for continuous operation at 150 C and up to 200 C under certain conditions. Available for both power and control cable circuits, it contains own built-in aluminum conduit. Claimed advantages are: resistance to flame, heat, moisture, corrosion and ozone; no conduits and related "pulling-in" problems; high dielectric strength; small diameter; and lightweight. Request bulletin 1088.

The Okonite Company, Passaic, New Jersey



Corrosive circulating water tamed here by these CRANE VALVES

THE CASE HISTORY—Almost 2 years' operation without any maintenance of valves on circulating water lines to condensers, and on priming and instrumentation systems—with no trouble in sight. That's the experience of Southern California Edison Company's 280,000 k.w. steam station at Etiwanda with Crane Packless Diaphragm Valves.

The plant's engineers knew that sediment in recirculated water would quickly cut out the seats in ordinary valves and its corrosive elements would attack working parts to make valve operation difficult.

Not so with Crane Packless Diaphragm Valves. Their sealed bonnet keeps working parts out of contact with line fluid—free of corrosive effects. Separate disc construction with pliable insert resists erosion—seats tightly even on foreign particles. Large or small, these valves operate easily with fewer turns to the cycle. Typical Crane quality throughout—they're made better to do the job better—a bigger value for the thrifty buyer.

CRANE No. 1610 PACKLESS DIAPHRAGM VALVES

No packing to maintain. Neoprene diaphragm has longer life because it seals the bonnet only—is not subject to the cutting and crushing encountered when also required to do the seating. Separate disc gives control of fluid even should diaphragm fail. Wide selection of materials and sizes. Write for folder AD-1942 or see your Crane Representative.

CRANE CO.

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VALVES • FITTINGS • PIPE • KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY . . . 1855-1955

More EQUIPMENT NEWS

Begins on page 162

8 pumps designed for varied applications in the power field

Self-priming hand pump

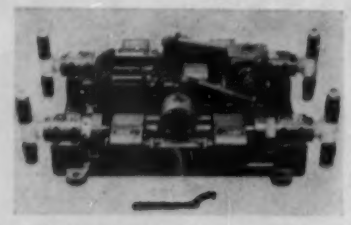
408 • *Flo-Master* pump is designed to handle a wide range of liquids including petroleum products, water, alcohol, etc, without corrosion. It has a die-cast aluminum-alloy pump body, composition piston rings and stainless steel shaft and valves. Rated at 25 gallons and delivering 1 qt for each complete stroke, pumps vacuum ability is about 25-ft suction lift. Details on request to manufacturer.

Blackmer Pump Company, Grand Rapids, Michigan

Submersible sump pump

409 • Pump has no outside floats or rods—motor housing is float and is adjustable to operating range desired. Unit will handle to 3250 gph and will operate in water to 15-ft deep. Switch and 1/3-hp motor are completely enclosed and sealed in a stainless steel housing. No lubrication is required.

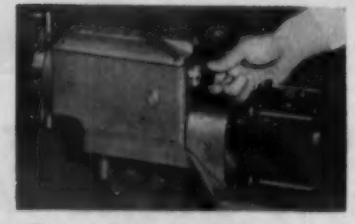
Carver Pump Co, Muscatine, Iowa



Plastic proportioning pump

410 • Pumps, capable of handling highly corrosive fluids, have capacities to 19 gph per feed and are available in 1, 2, 3 or 4-feed units. Plunger diameters from ¼ to ½ in. develop pressures to 300 psi; ⅝ to 1-in. plunger diameters are for pressures to 150 psi. Pump body and check valve assemblies are of unplasticized polyvinyl chloride or *Kel-F*. Maximum temperature at which *PVC* pumps can be used is 150 F; *Kel-F* pumps operate at temperatures to 250 F.

Hills-McCanna Company, 3025 N Western Ave, Chicago, Ill.



Pump for micro flow rates

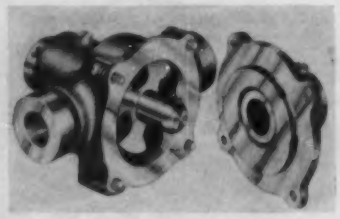
412 • Piston diaphragm pump will operate against pressures to 1000 psig and has maximum flow rate of 2400 ml per hr. No stuffing box, packing or running seal is used. Product is isolated from all pumping parts by a hydraulically balanced diaphragm. Pumping rate, established by length of piston stroke, is handset on dial indicator calibrated in 1000 increments. Request bulletin 500.

Lapp Insulator Co, Inc, 7 Gilbert St, LeRoy, New York

Sealless centrifugal pump

414 • Combining pump and motor in a single unit *Model CFH* gives head to 150 ft at capacities to 53 gpm. Pumped fluid circulates through rotor chamber of motor, isolated from stator parts by a stainless steel liner. This circulation serves to lubricate bearings and cool motor. Handles corrosive, explosive and "problem" fluids at temperatures to 450 F and pressures to 300 psi.

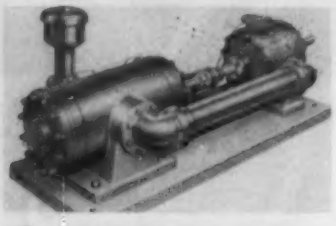
Chempump Corp, 1300 E Mermaid Lane, Philadelphia 18, Pa.



Variable cavity pump

411 • Pump is designed to maintain constant volume flow despite fluctuations in city water pressure. When pump pressure reaches predetermined point, spring loaded end plate moves outward, increasing length of pump cavity and enlarging clearances between ends of rotor and end plate. Increased clearances permit liquid to recirculate, reducing pump's maximum pressure. Manufacturer states pressures can be varied from 3 or 4 to 75 lbs.

Hypro Engineering Inc, 700 39th Ave NE, Minneapolis 21, Minn.



Compressor vacuum pump

413 • Two-stage 100-lb rotary air compressor/vacuum pump consists of separate low pressure unit coupled to high pressure unit, both mounted on a common bed plate. It is used for air systems, pneumatic conveyors, gas compression and similar applications. Available in 8 sizes to handle from approximately 250 to 1800 cfm and for pressures from 60 to 125 lbs. Full details on request.

Allis-Chalmers Manufacturing Co, Milwaukee 1, Wisconsin

Gusher coolant pump

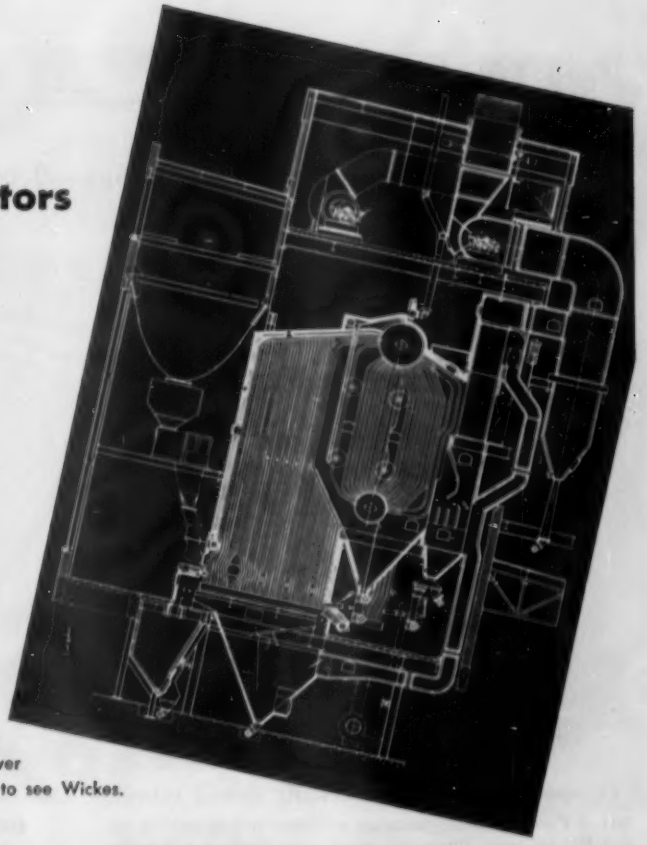
415 • Unit is designed for center coolant trough mounting on traveling base machine tool installations. Tapered tubular housing is provided with reinforced narrow section for passage through limited width slot in trough cover. Pump has no packing glands nor metal to metal contacts below liquid high level line. Liquids contaminated by dirt or abrasives can be handled.

Ruthman Machinery Company, Cincinnati 2, Ohio

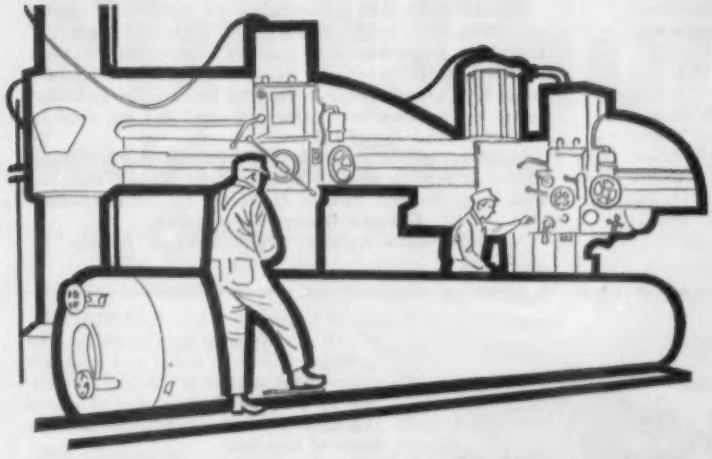
For more data on these items, use post cards p 171. Identify your request with item number.

WICKES

dependable steam generators for supplying heat and power in every kind of installation



Modern industry's need for heat and power doesn't come ready-made for a certain type or size of steam generator. Every installation is different. That's where the highly varied experience and extensive facilities of the Wickes Boiler Co. pay off for you in more dependable installations. Wickes engineers will design and build you a steam generator that is specifically suited to your purpose; one that will assure you of fine service for years to come, whether your installation is large or small, whether it's a schoolhouse or an atomic energy plant. Whatever the nature of your steam generator needs, it will pay you to see Wickes.



WICKES complete facilities for custom metal fabrication to exact specifications

When a company has been fabricating heavy-gauge metal assemblies for as many years as Wickes, and has built such a fine reputation for dependable products, it follows that all those skills and facilities can help you a great deal on custom fabricating jobs. We have the laboratories, the production equipment, and the inspection service to do the same excellent work for you that we do for ourselves. For exacting custom metal fabrication, write us about your requirements.

159

THE WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

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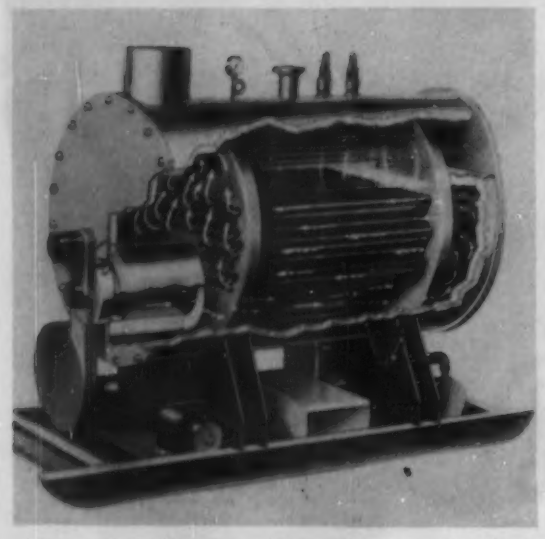
More EQUIPMENT NEWS

Begins on page 162

Boilers and auxiliaries—3 recent developments

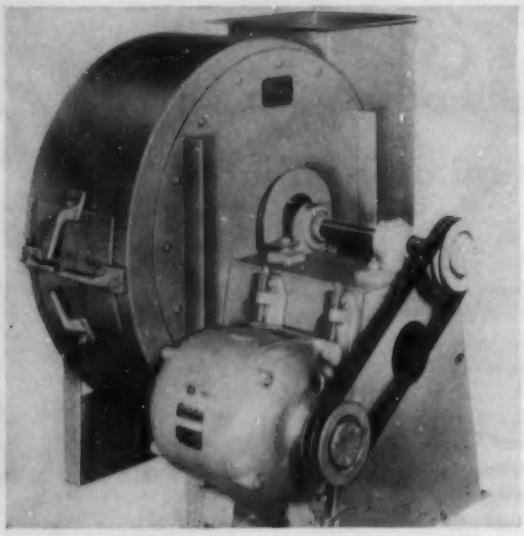


Compact boilers use internally finned tubes

401 • Packaged boiler units are available in standard 30, 60 and 100 hp sizes. Internally finned tubes produce a fire-side to water-side surface ratio of about 3:1; as compared to a 1:1.1 ratio for plain, bare tubes. Result is greater capacity in less space. In addition, internal finning increases turbulency of hot gases, and brings them into more intimate contact with the heat transfer surface.

Smaller in size than conventional boilers, these units can be installed where headroom is limited. Any number of boilers can be connected together with interlocking controls to provide any required capacity. All parts are accessible for inspection and cleaning. Due to high heat transfer rates of the finned tubes, the boilers are said to come up to full steam pressure in about 10 minutes. Units are built in accordance with section 1 of ASME boiler code. Request bulletin 542 for full details.

Brown Fintube Company, Elyria, Ohio



Induced draft fans for boilers to 320 hp

402 • Packaged unit includes fan, motor, motor base and adjustable speed V-belt drives to meet boiler requirements of 4500 to 50,000 sq ft edr. Models are available for oil, gas and coal fired boilers in sizes to 320 hp and 650 F.

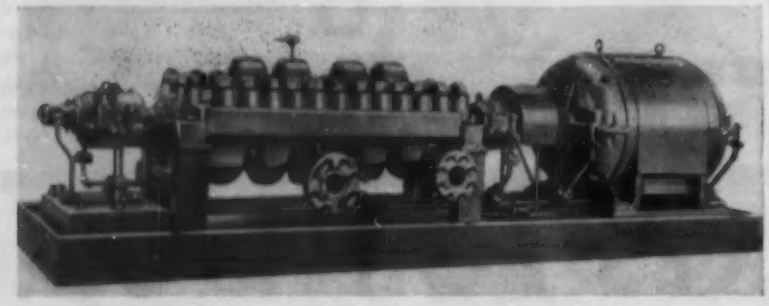
Constant boiler draft can be maintained regardless of weather conditions, stack height or placement. Fans will support 30 ft of ⅛-in. gauge steel stack properly braced with guy wires.

Motors are furnished with or without controls. Adjustable motor rails provide proper motor and belt tension and alignment. V-belt drives have adjustable speed and are sized for minimum load factor of 150%.

Housings are heavy steel plate construction, completely welded to provide air-tight operation and prevent distortion from heat. Request bulletin SI-101 for further information.

Chicago Blower Corporation, 9867 Pacific Avenue, Franklin Park, Illinois

For more data on these items, use post cards page 171. Identify your request with item number.



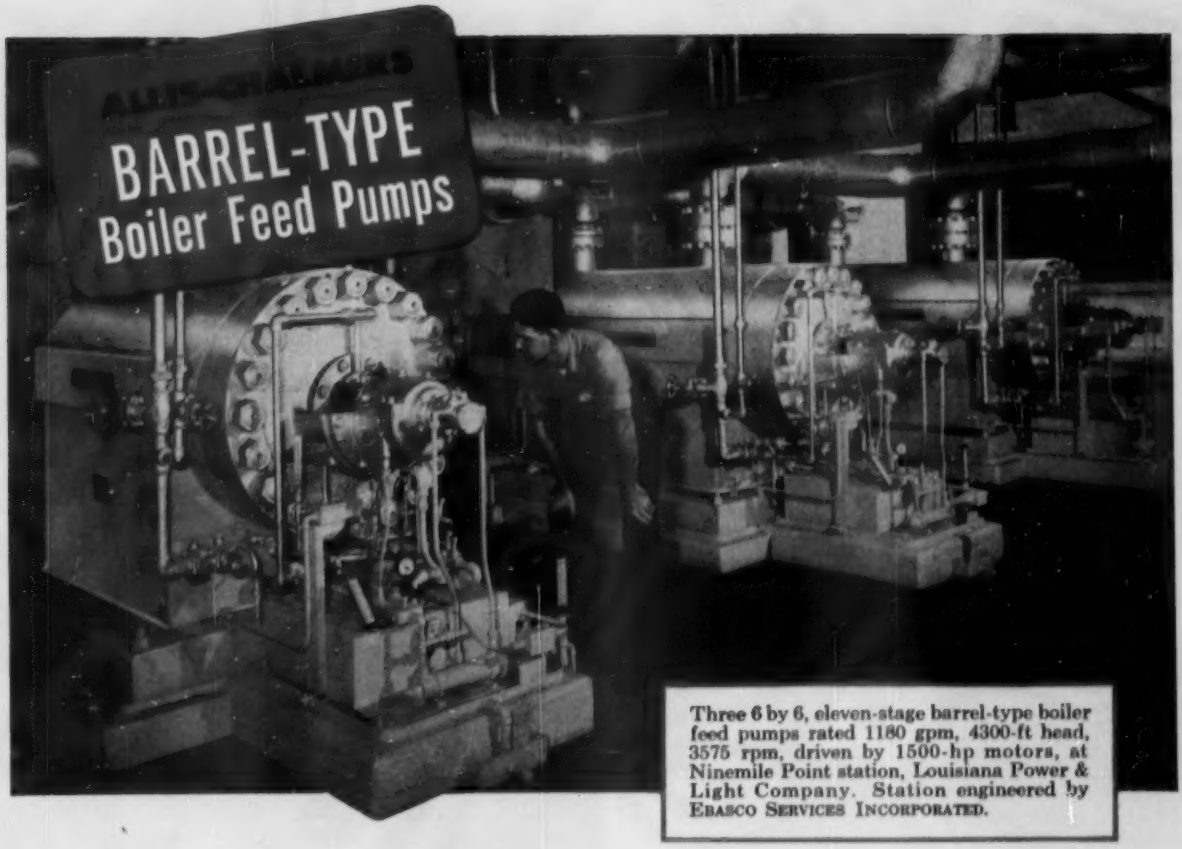
Boiler feed pump is designed for high pressure ratings

400 • *Type BI* boiler feed pump is designed to meet requirements of high pressure ratings below those of barrel-type pump classifications. Available in 6, 8 and 10 stages, pump is patterned after the barrel type, but has horizontally split casing so that upper half can be removed without disturbing piping. Capacity range of the 3 impeller sizes is 225-350 gpm, 275-425 gpm and 350-525 gpm. Head per stage is about 280-200 ft, 300-240 ft or 310-250 ft. Unit is designed for both radial and axial balance. Radial balance is obtained by alternate up and down arrangement of volutes and axial balance by back-to-back arrangements of impellers.

Pump's deep stuffing boxes are arranged for water cooling from external source. They are designed for packing against suction pressure only. In addition, if high suction pressures are encountered, bleed-offs can be taken to lower external pressure zone, thereby reducing packing pressure to desired level. Metallic packing is used in stuffing boxes and split-type glands are of bronze.

Casing wearing rings are provided with self-locking tongue and grooves. Companion impeller rings are fastened to impeller.

Allis-Chalmers Manufacturing Co, Milwaukee 1, Wisconsin



Three 6 by 6, eleven-stage barrel-type boiler feed pumps rated 1180 gpm, 4300-ft head, 3575 rpm, driven by 1500-hp motors, at Ninemile Point station, Louisiana Power & Light Company. Station engineered by EBASCO SERVICES INCORPORATED.

First Choice with Louisiana Power & Light Company

A proved service record the country over . . . simple, low maintenance design . . . high efficiency performance — these were some of the factors that led Louisiana Power & Light Company to choose Allis-Chalmers barrel-type boiler feed pumps for their Ninemile Point station.

Features Keep Operating Costs Low

First stage has twin, single-suction impellers to give low NPSH requirement for highest efficiency under fluctuating loads. Impellers, mounted back to back, balance axial forces without use of balancing drum. Double volute casing maintains radial balance under fluctuating load. Expansion joint and shaft seals are brought to outside of pump where they may be inspected often and worked on easily, if required.

Complete Unit From One Source

Allis-Chalmers can supply the complete pumping unit — pump, motor and control — of coordinated design and manufacture. You get one responsibility — one guarantee of satisfaction.

Get complete information on Allis-Chalmers barrel-type boiler feed pumps. Call your Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 08B7899.

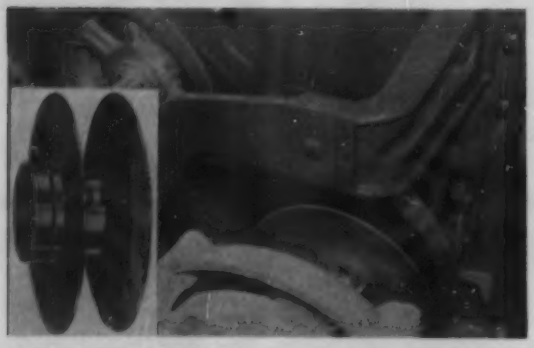
A-4635

ALLIS-CHALMERS

More EQUIPMENT NEWS

Begins on page 162

5 timely items that may meet your mechanical transmission needs

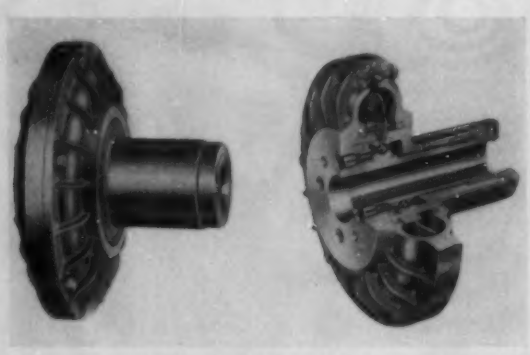


Adjustable speed drive transmits up to 30 hp

403 • Unit is reported to safely transmit up to a maximum of 30 hp. It is available in *Q*, *R* and *W* belt sections, and permits speed variation of as much as 100% at hp capacities comparable to former drives having 2 or 3 belts. Installation is said to result in saving of space and lower costs as compared with multi-V-belt units.

Drive has a single-groove wide-range adjustable-diameter sheave with double-taper hub construction. *Q* groove sheave has pitch diameter range from 5 to 8.5, *R* groove from 5.5 to 10 and *W* groove from 5.5 to 11. Motor base has single screw adjustment. Complete engineering catalog available on request.

The American Pulley Company, 4200 Wissahickon Avenue, Philadelphia 29, Pa.

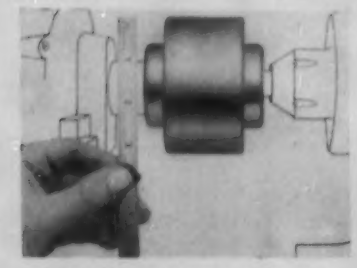


Dry fluid drive for industrial transmissions

404 • *Flexidyne*, described as a dry fluid drive, is claimed to handle difficult starting and reversing problems, and to give a new kind of protection against shock and overloads. Major advantage over fluid type drives is reported to be that at normal operating speeds it does not slip. At the same time, in case of an overload, it is slippage that gives protection.

Unit consists of a housing, inside of which a rotor is free to turn concentrically. Between the two are fine particles of spherical steel shot that acts like a fluid. This shot transmits power from the housing to rotor. Actual delivery dates for the unit have not yet been announced. Request complete operational and engineering data from manufacturer.

Dodge Manufacturing Corp, Mishawaka, Indiana



Medium-duty coupling

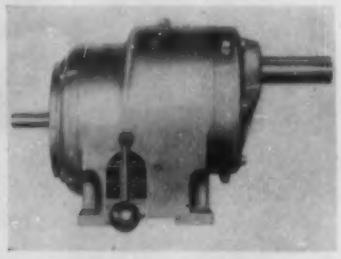
405 • Gear-type coupling, for connecting ⅛ to 1¼-in. shafts, is said to differ from conventional design in that it has a one-piece smooth sleeve. Hubs and sleeve are made of powdered steel with tensile strength of 35,000 psi. Spring steel snap rings can withstand 50,000 lbs of end thrust. Advantages, according to manufacturer, include positive gear drive, higher hp capacity, ease of assembly and uncoupling.

Sier-Bath Gear & Pump Co, 9252 Hudson Blvd, North Bergen, N. J.

Slip clutch assembly

406 • Precision slip clutch assembly is universal in design and is adjustable in torque. Torque transmitted is from ¼ to 10 in. oz as required through 3 small ground cork faces. Gear face will slip continuously when set static friction is exceeded. Unit is designed for ⅛, 3/16 and ¼-in. shafts. Standard stock pitches are 48, 64, 72 and 96 in 20 deg pressure angle. Full details in catalog 5, available on request.

PIC Design Corp, 160 Atlantic Ave, Lynbrook, L. I., New York



Sliding gear transmission

407 • Gearshift drive *Type R3DC* is built with capacity of 5 hp at 1800 rpm input and provides 4 constant hp output speeds when used with a single speed motor; 8 output speeds are developed when used with a 2-speed motor. Primary gear ratios are 4.15:1, 3.15:1, 1.85:1 and 1:1. In addition, 11 optional secondary gear ratios are available, ranging to a maximum of 2.25:1. Further information obtainable on request.

The Lima Electric Motor Co. 164 Findlay Road, Lima, Ohio

For more data on these items, use post cards page 171. Identify your request with item number.

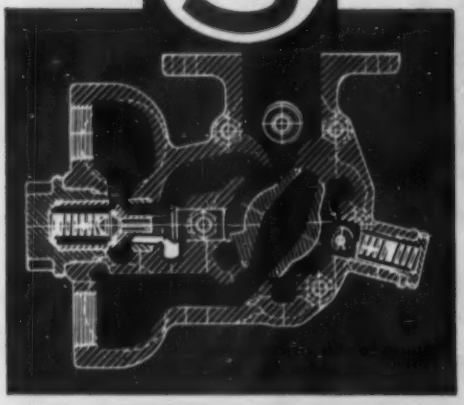
CHECK THESE TOO . . .

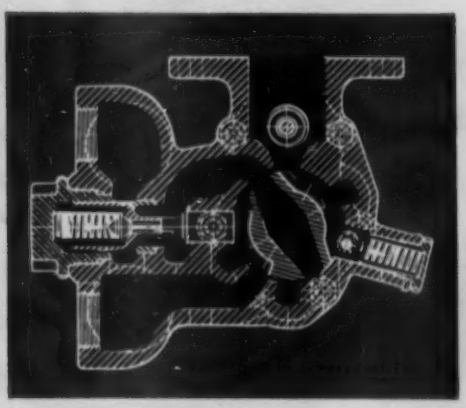
Electro-pneumatic valve . . . . p 176
Direct-lift solenoid valve . . . . p 178
Pillow blocks and flanges . . p 180
Fluted welding cable . . . . . p 182
Dual-type demineralizer . . . p 184
Industrial fan units . . . . p 186
Portable air compressors . . p 188
Teflon fibre yarn packing . . . p 188
Twin-unit package boilers . . . p 192
Seals for boiler feed pumps . p 194
Electro-mechanical governor . p 196

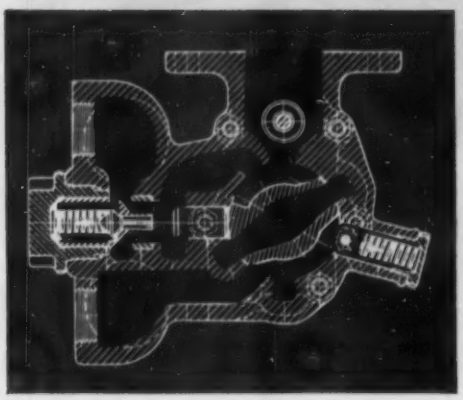
CASH STANDARD

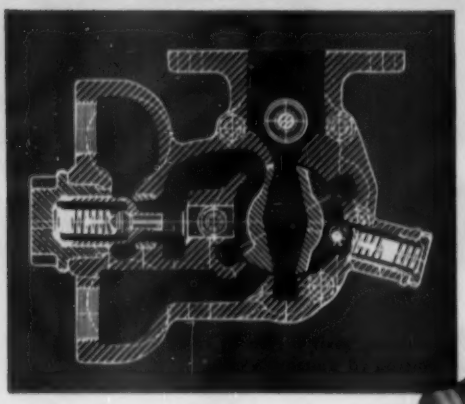
TYPE 555-RO

Four-Way Hydraulic Operating Valve









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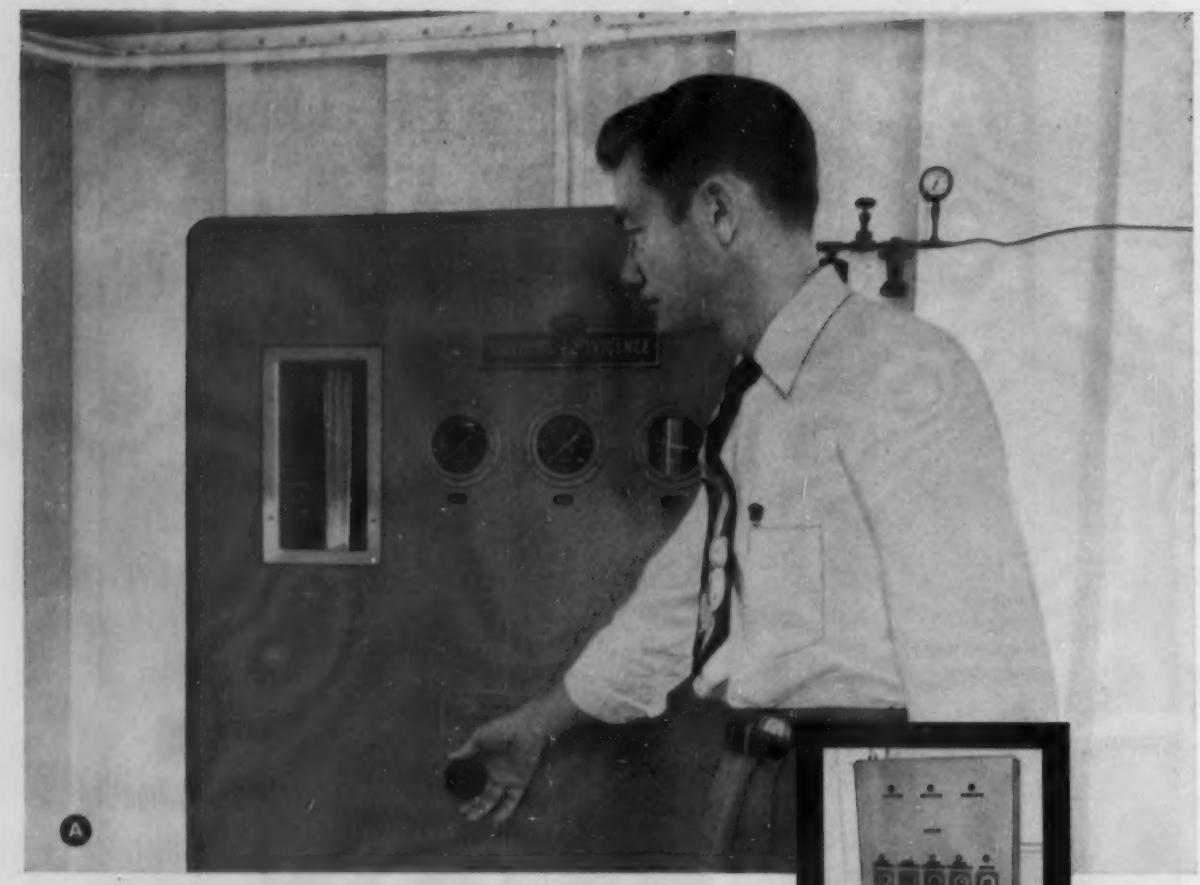
A. W. CASH COMPANY, P. O. Box 551, Decatur, Illinois

Pressure, Hydraulic, Temperature, Process and Combustion Controls



CHLORINIZER keeps 'em clean...

. . . AT STATION B OF SAN DIEGO GAS AND ELECTRIC CO., this Builders Model HCVS 3000 lb. per day Chlorinizer reduces to a minimum hand cleaning of condensers . . . keeps condenser slime under control throughout the year. To do the job, heavy chlorine dosages are "shot" to 4 points of application: 3 pump suctions and 1 open channel. Chlorinizer, with its simple tantalum diaphragm control valve and hydraulic control system, is ideally suited to this type of automatic time-sequence control. Very slight modification of the basic Chlorinizer (Photo A) was required. The companion-type control panel (see Photo B) is an economical combination of off-the-shelf components . . . easy to adjust or service . . . low in both initial and upkeep costs.

This installation was made in 1952 at the 100,000 KW Station B, and the Chlorinizer and control panel have been in continuous service since then.

Find out how Builders Chlorinizer can solve your slime control problems . . . in main condensers . . . in heat exchangers . . . in all types of cooling systems. For Application Memo 840-J9 describing Chlorinizer slime control system — also full details on Builders Chlorinizers — write Builders-Providence, Inc., 354 Harris Ave., Providence 1, Rhode Island.

BUILDERS-PROVIDENCE

DIVISION OF B-I-F INDUSTRIES, INC.

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AIR CONDITIONING, HEATING, VENTILATING

1 **Induced draft cooling towers** for industrial and air conditioning applications. Illustrated 20-page question-answer bulletin gives construction and selection data, typical installations. J F Pritchard & Co of California, 4625 Roanoke Pkwy, Kansas City 13, Missouri.

2 **Instantaneous heaters** designed to provide hot water for industrial and domestic use. Selection data, dimension tables, capacity charts in illustrated 56-page bulletin 54-78. American District Steam Co, Inc, N Tonawanda, N. Y.

3 **Converters** for hot water heating at working pressures to 125 psig. Selection tables, dimension charts, capacities in illustrated 16-page bulletin 504. Richmond Engineering Co Inc, 7th & Hospital Sts, Richmond, Virginia.

4 **Steam facts.** "What you should know about modern steam heating" is title of 16-page booklet. Includes data on basic steam physics, where and how to use steam, steam efficiencies. The Steam Heating Equipment Manufacturers Assn, 450 E Ohio St, Chicago 11, Illinois.

5 **Utility blowers.** Non-overloading units with backward curved blades. Dimensions, specs, performance data, photos of belt- and direct-drive, single and double width blowers. 48-page bulletin BC-11. Hartzell Propeller Fan Company, Piqua, Ohio.

★ **Utility fans.** Belt-driven and direct-drive centrifugal units. Construction features, applications, selection data in 24-page bulletin DS-248U. ★Request direct on company letterhead. The Trane Co, LaCrosse, Wis.

6 **Dust sampling.** Two reprint papers—"The magnitude of errors in stack dust sampling" and "A new method for stack dust sampling." Industrial Hygiene Foundation of America, Inc, Mellon Institute, 4400 5th Ave, Pittsburgh, Pennsylvania.

7 **Bin vent filter** for use where enclosure should be maintained under a slight vacuum to prevent escape of product or dust; where product is to be returned to process with no rehandling; where displacement air must be vented free of dust. Illustrated 4-page bulletin F-2053. The Ducon Co, 147 E 2nd St, Mineola, L. I., New York.

BOILERS AND AUXILIARIES

8 **Compact boilers** employ tubes with internal fins that are said to provide about 3 1/3 times greater fire-side to water-side surface ratio than obtained with plain bare tubes. 30, 60 and 100-hp units described in 6-page bulletin 542. Brown Fintube Co, Elyria, Ohio.

9 **Self-contained boilers.** Suggested boiler room layout, dimensions, specs in 4-page bulletin AD-137. Includes data on *model OB*, 15 to 100 hp; and *model LE*, 100 to 800 hp. Cleaver-Brooks Co, 316 E Keefe Ave, Milwaukee, Wis.

10 **Underfeed stokers** designed to handle loads of 100 to 360 developed hp. Cutaways, construction details of fluid ram and gear drive single retort units in 12-page bulletin SB53. Erie City Iron Works, Erie, Pennsylvania.

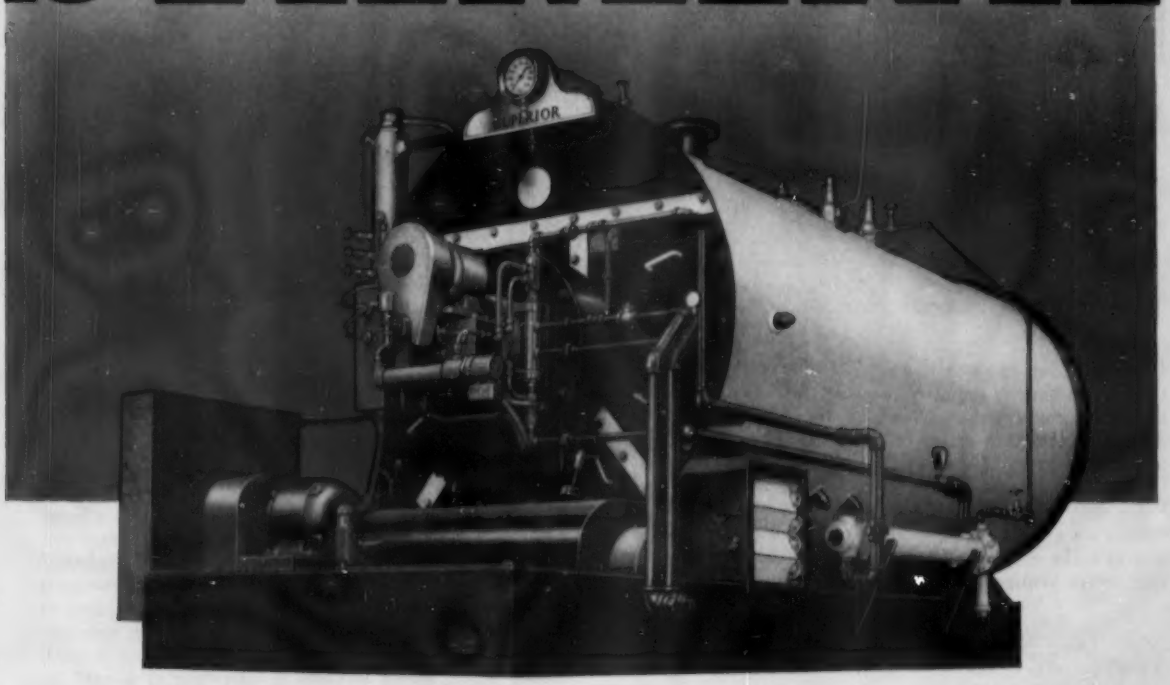
11 **Boilers** with capacities ranging from 10,000 to 50,000 lbs steam per hr. Construction features, specs, engr data for coal, gas or oil units. Illustrated 8-page bulletin WT-8. Wm Bros Boiler & Mfg Company, 1057 10th Avenue SE, Minneapolis 14, Minnesota.

12 **Boiler controls.** Photos, engr data, specs on steam boiler water level controls, pressure safety relief valves, pressure regulators, etc. Illustrated 12-page bulletin 54B. Watts Regulator Company, Lawrence, Massachusetts.

13 **Boiler refractories.** Illustrated 39-page bulletin R-36 discusses proper selection of refractory materials and requirements they must meet to avoid refractory failure. Contains data on uses of firebrick, insulating firebrick, castables, plastics and mortars. The Babcock & Wilcox Co, 161 E 42nd St, New York 17, N. Y.

(Continued on page 230)

STAMINA



for YEARS of low cost steam

Get the complete story. Write for Catalog 700 describing 18 sizes from 20 to 600 b.h.p; pressure to 250 p.s.i. burning oil or gas or both.

Boilers, too, grow old . . . and when the honeymoon of the first year or two is over, dirt, scale, and wear on moving parts start to take their toll in loss of efficiency. That's why Superior Steam Generators are built bigger, heavier, and more rugged, with four-pass construction and full 5 sq. feet of heating surface per boiler horsepower, measured on the smaller I.D. of the tubes. The relatively slow speed full bank induced draft fans, the larger triple-blow-down water column, and the rigid channel iron base are other typical features of design which add the stamina that makes efficient low cost steaming a reality . . . not for a year or two; but throughout the long life of the unit.

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George Edwards' Scrapbook

This guy knew his stuff

How would you like to give away $175,000,000? Hugh Roy Cullen, the king of the oil wildcatters did. For a guy who hadn't finished grammar school, he did OK. Cullen didn't depend on luck, but got so good at knowing where to look for oil that he brought in many abandoned oil fields—that top geologists gave up. Just read his book, *Hugh Roy Cullen*, a story of Aemrican opportunity

Here's a great book about a great American, who knows how to make money and what to do with it. It should inspire every youngster to be a better American.

Ain't no such animal

Most of us resist change unless the idea is ours. This is a common human trait and the sooner we realize it the more successful we will be in handling people, especially if they have ideas. To show how road blocks are thrown in the path of progress by otherwise intelligent people, this editorial appeared in a Boston paper only 78 years ago: "J Coppersmith was arrested in New York for attempting to extort funds from ignorant and superstitious people. He exhibited a device which he says will convey the human voice any distance over metallic wires, so a listener will hear it at the other end. He calls it a 'telephone.' Well-informed people know that it is impossible to transmit the human voice over the wires."

$2.16 per kw for electricity

For a progress report on electricity, you have a good example right here in our own back yard. For example, in 1882, white shirts sold for only 39 cents each, while one kilowatt of electricity cost 24 cents.

By 1953, the same shirt cost $2.95, while one kw of electricity was down below 3 cents. If electricity kept up with shirts, we would pay $2.16 per kw today. The answer is engineering. Fuels and equipment cost much more today, but a power plant is the nearest thing to automation.

Theories not wasted

False theories are not useless—they may point out the direction for further inquiry.—*V J Cushing*

Keeping white elephants?

The sacred animal of Siam is the white elephant. Being very rare, it is considered sacred and, therefore, must do no work. Only an extremely wealthy person, like a king, can keep white elephants. They must be well groomed and fed—and after all, an elephant "eats like an elephant."

One Siamese king had the cute practice of presenting a white elephant to any of his courtiers that he wished to ruin. It was a present from his ruler, so the unhappy recipient could do nothing but keep the costly animal, feeding it and hiring servants to take care of it until he was finally ruined. So having such an animal meant supporting an expensive and highly unprofitable item.

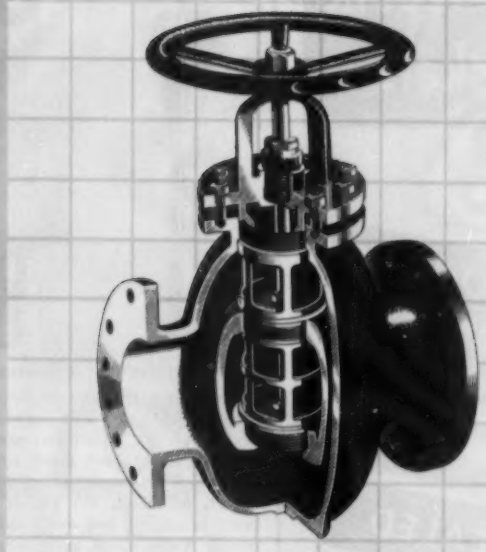
Before we feel sorry for the poor courtier who received such a gift, let's look around our own plants. I can't think of worse white elephants than outdated equipment units that swill up tons of expensive fuel and maintenance needlessly. Like the sacred animal, after wasting fuel, such obsolete machinery takes a crew of servants to maintain it. This goes on and on until the firm either goes bankrupt or until competitors who don't have such "gifts" to support, price them out of the market. Difference with us, though, is we don't have to keep them as the courtiers did—we can replace them with efficient work elephants.

As power engineers in charge of the power services, you and I have the job of looking around and pointing out our white elephants to top management. Bet you'll be surprised at the number in your plant.

Does education pay?

Knowledge is power, and to prove it, here are latest government figures. Average college graduate can now expect to earn about $300,000 in his lifetime, high-school graduate about $200,000, and grade-school graduate $100,000 or less. Show these figures to junior and see if they won't motivate him to get his sheepskin. It doesn't matter if he gets it on spare-time study, so long as he gets it.

George Edwards
Engineer



No seat — consequently no regrinding.

Can be serviced in the line.

Unaffected by wiredrawing.

Unaffected by throttled use.

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THE KLINGER SEATLESS PISTON VALVE operates on an entirely different principle from the usual type of seating valve. It consists basically of a finely ground piston, operated by the valve spindle and hand-wheel and moving through two or three non-metallic, resilient valve rings, capable of resisting steam, oil and most fluids, at high temperatures and pressures and separated by a ported lantern bush. It is made in a great variety of designs and sizes to suit all purposes.

Write for the Klinger Master Catalog which describes the complete range of Klinger products.

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■ AJAX Spiral Wound metal-asbestos gaskets provide positive seals at lower bolt loads because they are literally "spring loaded". The U-shaped form of the interlocking metal plies provides automatic reaction to mechanical compression, internal pressure variations and temperature changes. They "breathe" with variations in pipe line stresses and normal bolt relaxation.

And because they do not lose their resiliency under compression they may be used over again, should it be necessary to break the joint.

There are types and sizes for all standard flanges and for manholes, handholes and tube caps for all makes of stationary and marine boilers, water walls, economizers, etc.

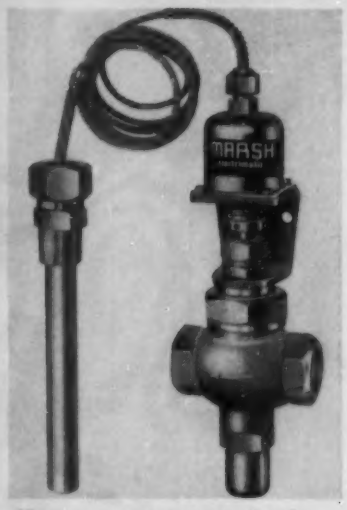
Ask Your Industrial Distributor
or write for Catalog No. AG-953

UNITED STATES GASKET COMPANY
CAMDEN 1, NEW JERSEY

USG | FABRICATORS OF FLUOROCARBONS & OTHER PLASTICS
Representatives in principal cities throughout the world

More EQUIPMENT NEWS

Begins on page 162



Temperature actuated valves

436 • Two temperature actuated valves are manufactured with standard capillary length of 5 ft. However, special lengths may be had to suit every application.

Type WT is designed to control flow of water, brine oil, air, gas or other fluids used in cooling and other industrial processes. Valve opens with rise in temperature and closes with temperature drop. Temperatures range from 20 to 220 F, liquid pressure range is 150 psi, steam limited to 15 psi.

Type HT is used to control flow of hot water or low pressure steam used in heating or other industrial processes. Its main use is in heat-exchangers and heating, but may also be used as by-pass control in cooling and process service within temperature limits of the valve. Temperature ranges and fluid pressure ranges are the same as the *WT valve*. Complete details on request.

Jas. P Marsh Corp, Skokie, Ill.

For more data on these items, use post cards p 171. Identify your request with item number.

Electro-pneumatic valve

432 • Electrically operated valve is designed to handle air only. Particular design feature, according to manufacturer, is quiet operation. Spring, armature and guide tolerances, and material specs are closely held to prevent alternating current hum.

When energized, valve passes full air at

BOTH ARE OILS—

BUT ONE'S A MASTERPIECE!

In Lubricating Oil, too, there's no substitute for Quality!

"Look-alikes"—in lubricating oils as in oil paintings—can fool you. But they can't fool a machine. Famous Gargoyle oils prove this point.

You can copy the physical specifications of a Gargoyle oil, but you can't copy the 89 years of experience and skill that transform these specifications into products of unsurpassed quality. Vary the ingredients or the way they're compounded even slightly, and you wind up with an oil that, at best, may do no harm. But neither can it possibly bring you the benefits the original was designed to deliver.

This *inherent quality* is only part of the Gargoyle picture. With it goes the world's greatest lubrication engineering service. We analyze your plant machinery—work with your personnel to set up a complete program of *Correct Lubrication* that will improve your production, cut maintenance costs.

Why accept substitutes for *your* plant?

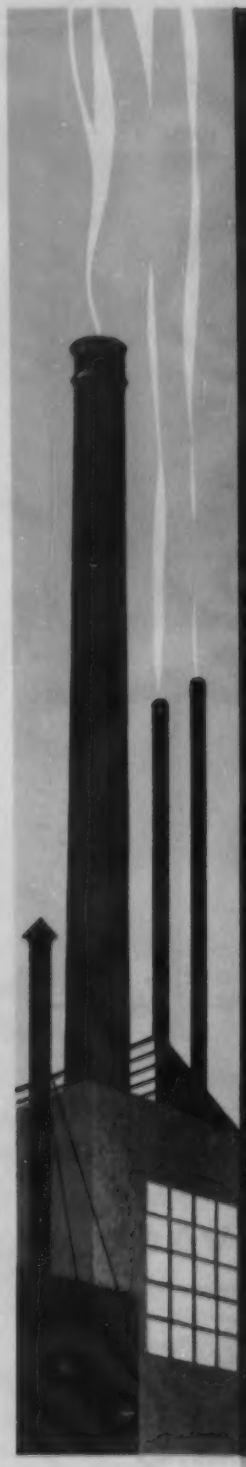
SOCONY-VACUUM

SOCONY-VACUUM

Correct Lubrication

FIRST STEP IN CUTTING COSTS!

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION



2487 YEARS OF RELIABILITY

To think ahead... look back!

Laclede Stokers have been operating for 2487 years in **municipal, state and federal institutions**—schools, colleges, hospitals, water works, penal institutions, children's homes, homes for aged, arsenals, air force bases and office buildings.

Many of these stokers are located in areas with a limited supply of technically skilled labor. Many have no stand-by power available. Continuous, uninterrupted operation has been achieved.

These Laclede Stokers, some of which are over forty years old, have operated satisfactorily for an **average of seventeen years.**

●

WRITE FOR BULLETIN #5010 ON OPEN FURNACE INSTALLATIONS SHOWING STOKERS APPLIED TO VARIOUS BOILER TYPES.

Founded in 1904

LACLEDE STOKER COMPANY

4440 HUNT AVE. • ST. LOUIS 10, MO.

More EQUIPMENT NEWS

Begins on page 162

supply pressure to 25 psi. When deenergized, supply port is stopped and return line pressure is wasted to atmosphere. Built-in manual adjustment permits valve opening when coil is deenergized.

Port connections are ⅛-in. NPT and 60 cycle coils can be supplied for 115, 208, 230 or 440 v. Further information in bulletin 359, available on request.

The Powers Regulator Company, Dept PRN, Skokie, Illinois

Line of 600-lb valves

433 • Redesigned line of 600-lb globe and angle stop, check and non-return cast steel valves are reported to have improved internal streamlining that lessens wear and reduces pressure drop. New features include swivel disk construction, stellite faced disks guided the full length of travel using integrally cast guide ribs, and integral stellited seats. Additional information on request to manufacturer.

Edward Valves, Inc, 1201 W 145th St, East Chicago, Indiana

For more data on these items, use post cards p 171. Identify your request with item number.

Direct-lift solenoid valve

434 • Packless valve is designed for low pressure applications to 7 psi and is available in ⅜ and ½-in. pipe sizes. Only moving element is stainless steel core and com-

Specify CHAPMAN STEEL VALVES

in any of the Standard Alloys

to meet your steel valve needs

When you specify Chapman Steel Valves you also specify steels designed for your specific services. Standard alloy steels match every normal industrial requirement. Special alloys can be furnished for extraordinary service conditions. All metals are poured in Chapman's own foundries under rigid laboratory supervision.

Exceptionally close machining tolerances are another standard feature of Chapman Steel Valves. Under the most severe conditions, Chapman Steel Valves seat tightly and positively, without jamming, chattering, or wearing excessively. Operation remains smooth and dependable; maintenance costs stay low.

See Chapman *first* for gates, globes and checks in all pressure classes — 150, 300, 400, 600, 900, 1500 and 2500 pounds — and for temperatures to 1150°F. Valves are available with welded, pressure seal, or bolted bonnet joints and with flanged or welding ends. ASA standards are equalled or exceeded in every range. Write for Catalog 20.

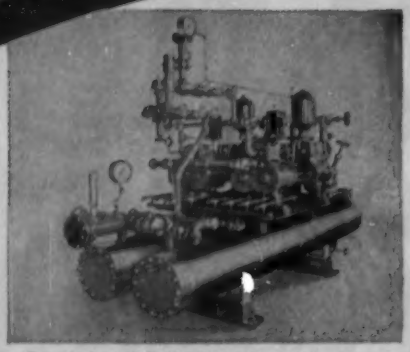
THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

Enco Automatic
OIL PUMPING
AND HEATING SYSTEM

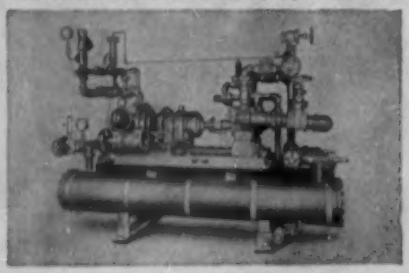
Completely Coordinated

Every detail part of an Enco Automatic Oil-Heating-and-Pumping Unit System is designed, assembled, checked and tested to make sure that it functions as an element of a completely coordinated unit. The sizes of pipes, fittings, valves and other elements are correctly proportioned for the efficient, dependable operation of the unit as a whole. All hand controls are visible and within reach of the operator for quick starting, stopping or cross-over reconnections between duplicate heaters and pumps. Adjustments and cleaning are similarly simplified.

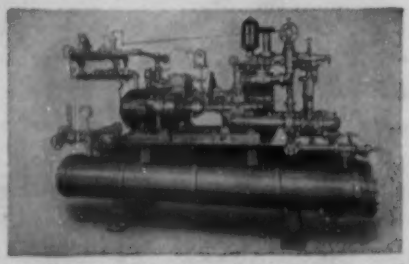
Single or duplicate heaters and electric or steam-driven pumps are used. Interconnected duplicate units give full capacity with either pump or either heater. Capacities range from 100 to 5000 G. P. H. of heavy bunker oil.



Two Horizontal Duplex Piston Type Steam Pumps and two fuel oil heaters—capacity 15 G. P. M. at 250 lb. pressure with either pump or heater.



One Turbine and One Motor Driven Pump and two fuel oil heaters. Capacity 30 G. P. M. at 150 lb. pressure with either pump or heater.



One Horizontal Duplex Piston Type Steam Pump and one Motor Driven Pump and two fuel oil heaters. Capacity 20 G. P. M. at 300 lb. pressure with either pump or heater.

BULLETINS ON REQUEST

OB-37 On oil burning, pumping and heating equipment.

OB-38 Instruction book on care and operation of oil-burner installations.

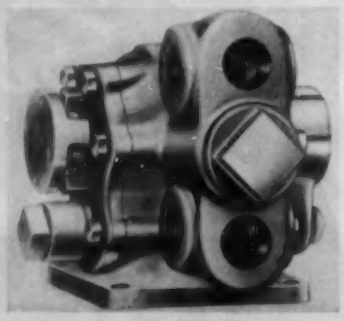
THE ENGINEER COMPANY
75 WEST STREET Enco NEW YORK 6, N. Y.

More EQUIPMENT NEWS

Begins on page 162

position disk. Designed primarily as a gas pilot control valve on power boilers, it is also recommended for low pressure air and gas control on gas fired ovens and furnaces, automatic dispensing units, vacuum holding applications and similar units. It can be used to control air, gas, propane, butane, water, gasoline, light fuel oil and other fluids to 180 F. Details on request.

Automatic Switch Company, Orange, New Jersey



Four-way hydraulic valve

439 • Single, self-contained mechanism actuates one to three hydraulic cylinders, and is designed for 300 to 1500 psi pressures, with capacity of 400 gpm at 1500 psi. Principal features are reported to include full floating position, built-in bypass to minimize piston creep, and ball-bearing minimum-friction construction.

A W Cash Co, Box 551, Decatur, Illinois

For more data on these items, use post cards p 171. Identify your request with item number.

Pillow blocks and flanges

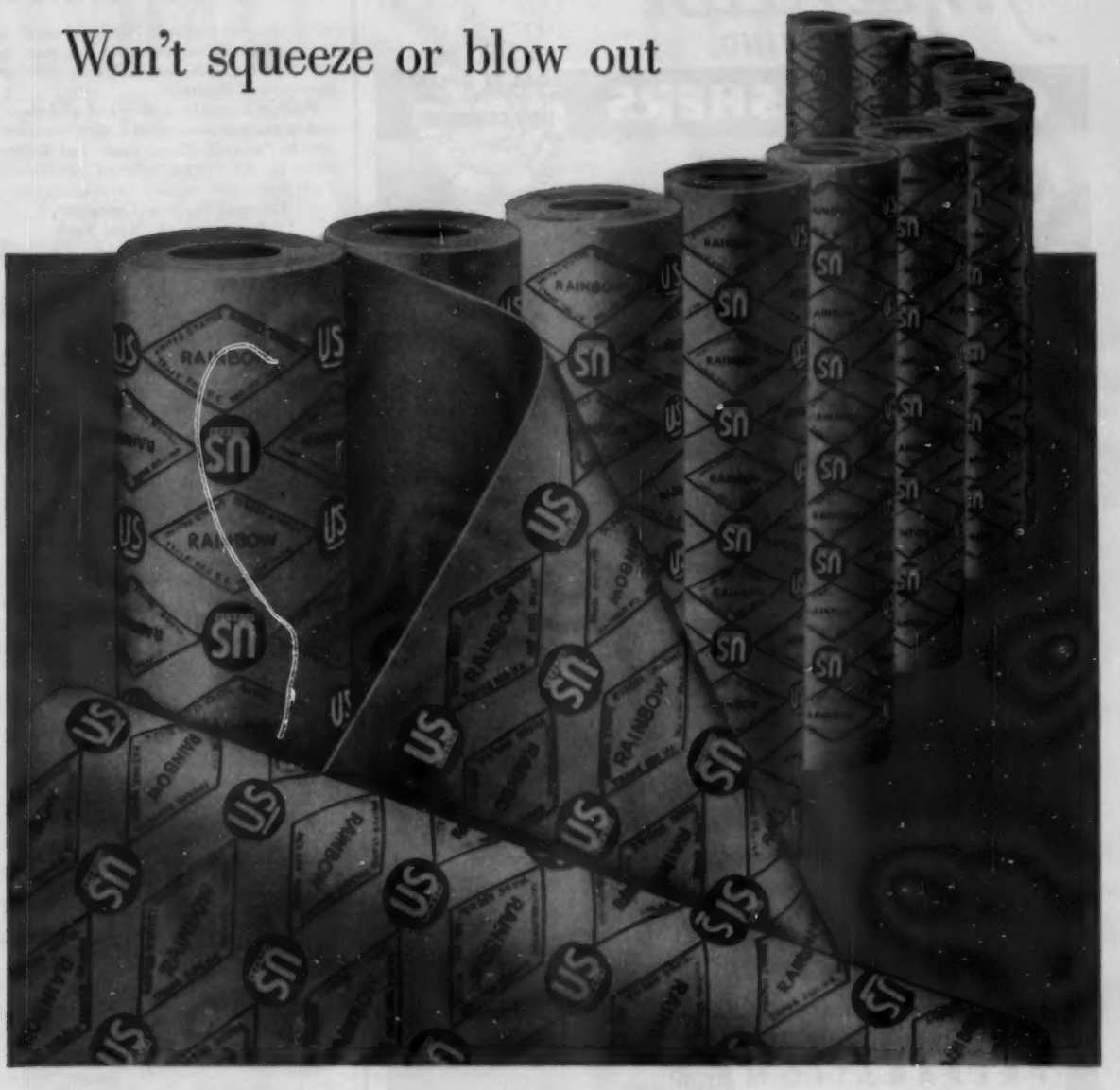
450 • *Series SP* pillow blocks and flanges are made in shaft sizes from ¾ to 2 15/16 in. Construction features include reinforced housing, improved shaft lock and dustproof seals. According to manufacturer, units offer greater bearing capacity, increased alignment range, and greater degree of interchangeability. Details on request.

Ahlberg Bearing Co, 3025 W 47th St, Chicago 32, Illinois

Low-hydrogen electrode

422 • Low-hydrogen electrode, with powdered metal added to coating, is claimed to provide faster and easier operation than conventional units. In a controlled test, according to manufacturer, a deposition rate of 61% faster than conventional E-6016

Won't squeeze or blow out



U. S. Rainbow...the *first* Red Sheet Packing

U. S. Rainbow® was the first Red Sheet Packing ever introduced to industry. And although that was as far back as the year 1889, Rainbow has *always* been the standard by which other Red Sheet Packings have been measured. Actually, its performance has *never* been equalled.

The big point about Rainbow is that it will never blow or squeeze out. It is so pliable that it fills up any irregularities in the flange and is highly resilient. *Yet it is always firm enough to make a tight joint.*

For packing flanges and other parallel surfaces against hot or cold water, air, saturated steam pressures up to 150 pounds, and all hydraulic conditions, play safe and pick Rainbow. Look for its familiar diamond trademark. Quick delivery from any of the 27 United States Rubber Company District Sales Offices, or from the address below.

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"U.S." Research perfects it.
"U.S." Production builds it.
U.S. Industry depends on it.

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

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American
ROLLING RING
COAL CRUSHERS
COAL IS SPLIT NOT CRUSHED
for More Uniform
COAL
PREPARATION
Proved by Hundreds of Millions of Tons of Reduced Coal.
Coal Crushers up to 800 TPH
Sample Crushers up to 15 TPH
COAL PREPARATION PROBLEM?
Write for Recommendations and Literature.
American
PULVERIZER COMPANY
1349 MACKLIND AVE. • ST. LOUIS 10, MO.

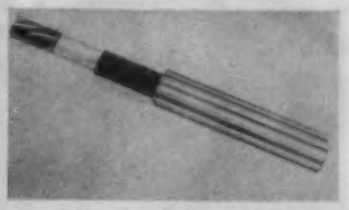
More EQUIPMENT NEWS

Begins on page 162

electrodes was realized. Powdered metal in coating contributes to weld making possible the higher speeds, and helps to stabilize operation of electrode.

Product is usable on alloy and mild steels, and meets requirements of E-6016 classification in "as-welded" condition, and E-7016 class in the "stress relieved" condition. Full details on request to manufacturer.

General Electric Company, Schenectady 5, New York



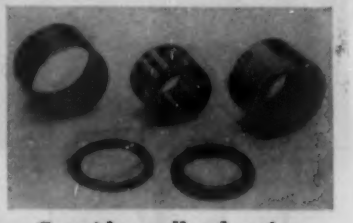
Fluted welding cable

417 • Fluted welding cable is long wearing on all types of welding equipment and, according to manufacturer, has greater impact resistance than even special cable constructions. Lightness and unusual flexibility is said to make it easier to weld in cramped quarters, cuts down "drag" and reduces operator fatigue. Fluted jacket gives better grip and is cooler to handle, since its greater surface area dissipates heat faster than conventional round welding cable, manufacturer states.

Jacket is made of 60% natural rubber compound. Rayon reinforcing braid provides a non-slip bond between jacket and insulation. Conductors are wrapped with an insulating paper tape. Details on request.

U.S. Rubber Co, Rockefeller Center, New York 20, New York

For more data on these items, use post cards p 171. Identify your request with item number.



Cartridge roller bearing

435 • Self-contained unit consists of outer race, roller assembly, retaining disk and seal. Ease of installation is said to make it suitable for numerous uses. Besides substituting for plain bushings, it can be used in caster and wheel housings, and in gear boxes or gear drives.

Units are available for ½ to 1⅝-in. shafts and 1⅛ to 2½-in. housing bores.

Rollway Bearing Company, 541 Seymour St, Syracuse, N. Y.

Wire ropes have steel core

419 • Wire ropes, with steel cores, have 15% greater strength than strongest grade marketed heretofore, manufacturer states. Longer rope life is claimed since higher resistance to wear from bending and abra-

(Advertisement)

HALL INDUSTRIAL WATER REPORT

Hall Laboratories, Inc.—Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

Volume 3 APRIL 1955 Number 2

It Takes a Lot of Water Conditioning To Deliver the Kilowatts

Current expansion in the public utility field to supply industry with more power and to bring electrification to greater areas demands careful planning for future water requirements, as well as active attention to existing water uses. Experts in utility station management turn to experts in water management for continuing consultation on water treatment and control.

Hall Laboratories now performs this service for some three hundred utilities, many of them on a system-wide basis.

Design of New Facilities

Constructors of a new utility plant on the West Coast made use of Hall's headquarters engineers in a three-way consultation to centralize information on: water availability and requirements from the plant; water characteristics from Hall field engineer E. R. Lang; and plant design from the constructors. A realistic report on cost and operation of suitable pretreating equipment resulted from the analysis.

The station has recently started operation with continuing supervision of water conditioning practice by Hall Laboratories.

Tailoring Water to Fit a Plant

Another western utility, whose existing plants were operating with Hall Service, withheld a final decision on the location of a new station until an adequate water supply could be developed.

Again, working with the constructors and the client, Hall Laboratories first analyzed samples from all available sources over a time period calculated to include representative conditions throughout the year. One sample was even taken during a flash flood, and provisions made for such extreme conditions.

With the data thus collected and the information on system requirements from the client and constructors, Hall staff engineers S. R. Osborne and A. M. Henricks went to work on recommendations for water treatment facilities. A detailed report covered preparation of water for: recirculating cooling water; cooling water for bearings; feedwater to the evaporator and drinking water. The Hall report included estimated comparative costs of alternative chemical treatments and diagrams indicating all equipment with specifications of capacities to simplify study of the various alternatives.

This power station has just gone into operation with Hall field engineer R. M. Tarr on the job to help plant engineers and chemists set up the exact conditions they need for the best operation of their new facilities.

Minimizing Treatment Costs

In other cases, plant surveys by qualified water-treatment engineers can obviate the purchase of costly equipment.

Hall engineers J. E. Summerville and M. C. Scott worked on a problem of this kind with a southeastern utility plant supplying a large rural area. The plant drew its water from three wells. Soluble iron and iron bacteria in the well water caused iron deposits in the plant water lines, recirculating cooling system and heat exchangers. Lines carrying cooling water to bearings had to be cleaned every three months to prevent complete plugging. Plugging of oil coolers occurred.

Iron removal would have involved a capital expenditure of $20,000 to $25,000 for equipment plus an annual chemical cost of $15,000 to $19,000. When Summerville and Scott estimated comparative cost of $1800 for equipment and $8000 for chemicals to control iron by Calgon® treatment, the plant deferred consideration of the pretreatment facilities.

Later reports showed that the co-operation of the plant personnel in carrying out the recommendations for controlling the iron and organic growths in the system had paid off. The water side of the condenser was free of deposit, the cooling tower was in good shape and oil coolers no longer plugged. Organic growth was under control.

* * *

Delivering kilowatts to all types of customers is the business of electric power stations. By adding the broad experience of Hall Laboratories to the specific knowledge of their own technical staffs, these companies feel better prepared to keep water troubles from interfering with production of power.

Boiler Feedwater Studies

Hall Laboratories participated in two papers sponsored by the Joint Research Committee on Boiler Feedwater Studies and presented at the 1954 annual meeting of the American Society of Mechanical Engineers in New York. M. D. Baker of West Penn Power Company and V. M. Marcy of Hall reported on "Hydrazine As An Oxygen Scavenger—A Progress Report on Tests at Springdale Station." J. D. Ristroph of Virginia Electric and Power Company and E. A. Yorkgitis of Hall presented a paper on "Controlling Iron and Copper Pick-Up with Neutralizing Amines." Preprints of the papers are available in limited quantities from the A.S.M.E. under No. 54-A-271 and No. 54-A-262, respectively.

Industrial Water Problems Require Special Handling

There are no "stock answers" to industrial water problems. For information, write, wire or call Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

Water is your industry's most important raw material. Use it wisely.

... make every step a safe step

BLAW-KNOX ELECTROFORGED® STEEL GRATING and STAIR TREADS

On stair treads, walkways, catwalks, platforms and floors—both indoors and outdoors—you can provide safe walking conditions. For Blaw-Knox Electroforged Steel Grating brings you these exclusive features:

1. rigid one-piece construction—easy to install
2. non-slip twisted crossbar—for safe footing
3. three types of bearing bars
   - square bars—for smoothest walking surface
   - knurled bars (Furro-Grip)—for extra safety plus relatively smooth walking surface
   - serrated bars—for maximum safety under extremely hazardous skid conditions
4. no sharp corners to clog—self-cleaning
5. all surfaces accessible—easy to paint
6. maximum open area—for light and ventilation

Write for your copy of new Bulletin No. 2486 —or send dimensional sketch for quotation.

BLAW-KNOX

BLAW-KNOX COMPANY

BLAW-KNOX EQUIPMENT DIVISION

Pittsburgh 38, Pennsylvania

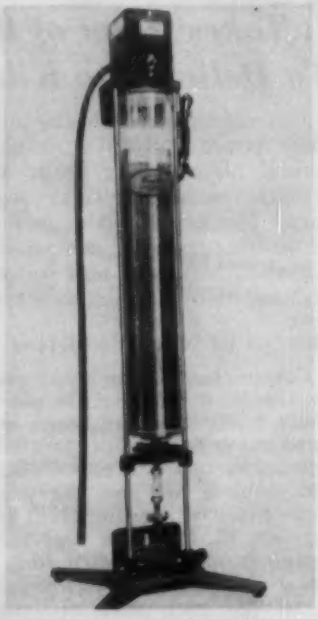
GRATING APPLICATIONS: floors • platforms • walkways • catwalks • stair treads • fan guards • shelving • and many other uses, both outdoors and indoors, for versatile steel grating

More EQUIPMENT NEWS

Begins on page 162

sion is obtained. Product is recommended for industries that use wire rope with independent wire rope core, such as construction, oil, manufacturing, logging, mining and marine. Complete details on request.

John A Roebling's Sons Corp, Trenton 2, New Jersey

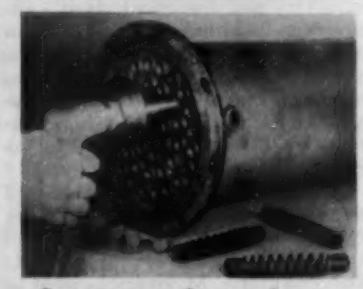


Dual-type demineralizer

438 • Mono-column demineralizer can be be used with single bed of mixed cation and anion resins, or as a two bed system with separate cation and anion resin beds in the single column. Unit produces to 10 gpm of demineralized water with as little as 10 grains sodium chlorides. If desired, unit can remove silica and CO_2 as well, through use of special resins. Regeneration is said to be simple and fast with costs of regenerant chemicals only about 10c.

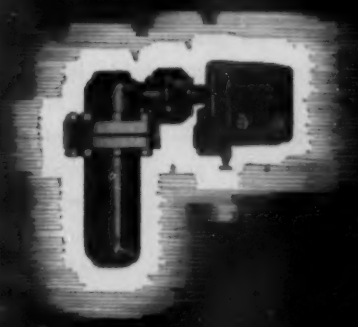
Penfield Manufacturing Co, Inc, 19 High School Ave, Meriden, Conn.

For more data on these items, use post cards p 171. Identify your request with item number.



Gun-type condenser cleaner

420 • Air or water operated cleaner is useful for removing soft deposits, such as mud, algae and similar accumulations from condensers in steam power plants and in refrigeration, air conditioning and process industries. Gun makes use of plug shooting



THE DEPENDABLE PERFORMANCE OF **FISHER** LEVEL-TROLS
IS ESTABLISHED BY THE TENS OF THOUSANDS OF THESE UNITS
IN WORLD WIDE SERVICE

FISHER GOVERNOR COMPANY • Marshalltown, Iowa

WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

Another EDGE MOOR
Package Steam Generating Unit

This 250 HP stoker-fired boiler is representative of Edge Moor achievement in boilers and steam generating equipment. Capable of supplying steam at 200 lbs. pressure at a rate of 15,000 lbs. per hour, the entire unit was shipped assembled. After being unloaded at its destination, the boiler was ready for installation of the stoker and erection of the front and bridge walls, since water-cooled side walls are an integral part of the assembly. It represents another tribute to Edge Moor's 88 years of tested knowledge gained through trial and practice, coupled with skill and accomplishment in production.

This is but one of many Edge Moor Boilers. Other types are available in a wide range of capacities, pressures and accessory equipment.

Write for Bulletin

EDGE MOOR
Manufacturers of
Steam Generating
Equipment
Since 1867

EDGE MOOR IRON WORKS, DIVISION OF

CONDENSER SERVICE & ENGINEERING CO., INC.

Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries

164 OBSERVER HIGHWAY
HOBOKEN, N. J.

CONSECO MAINTENANCE DIVISION

Conseco maintenance division has been repairing, rebuilding, modernizing, and maintaining equipment used in the power, chemical, refining, and marine industries for over a quarter century. Our highly mechanized field crews are supervised by qualified engineers and backed by specialized manufacturing facilities and ample replacement parts. Thus you are assured of fast, efficient results at lowest cost. Conseco service is as near as your phone.

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For Service

ANY HOUR
Day or Night

ANY DAY
Including Holidays

ANYWHERE
On the Continent

More EQUIPMENT NEWS

Begins on page 162

or washing method. Unit weighs 2 lbs and has aluminum housing with removable bronze nozzle and rubber spray shield. Either corded-rubber plug or nylon spiral brush projectiles may be used and are brush projectiles may be used. Available with outside diameters of ½ and 1 in.

Thomas C Wilson, Inc, 21-11 44th Ave, Long Island City 1, N. Y.

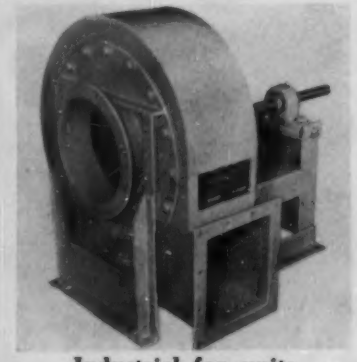
Condenser tube erosion clip

440 • Stainless steel clip is devised to protect condenser tubes from erosion. Open side of clip, made from 26 gauge metal with slightly flaring sides for tension, is attached directly to condenser tube. Clips are available in 2-ft lengths for ¾, ⅞ and 1-in. diameter condenser tubes.

Use of clips does not appreciably affect heat transfer rate of tubes, manufacturer states. While clip does not repair an eroded tube, it resists further erosion.

Allis-Chalmers Manufacturing Co, Milwaukee 1, Wisconsin

For more data on these items, use post cards p 171. Identify your request with item number.



Industrial fan units

426 • These fans have uses in all types of industrial air-handling applications. Standard designs may be utilized for a wide variety of substances including clean or dirty air, fumes, dust, refuse, shavings or stringy material. Specialized fans are available for conveying explosives, gases to 800 F, or corrosives. Sizes range from inlet diameters of 11 to 38 in., pressures to 17-in. sp, and capacities from 500 to 46,000 cfm. Advantages claimed by manufacturer include: easy removal of wheel from housing for cleaning or maintenance; static and dynamic balancing of wheel; heavy-duty

A. P. GREEN

Plastic and Castable Monolithic Linings Give Higher Operating Efficiency . . . Lower Maintenance Costs in Watertube Boilers

Monolithic refractory linings, properly installed, give better combustion efficiency and longer service life than any other type lining.

During operation, the sections of a furnace are subjected to different conditions. Each A. P. Green product has been developed to meet the service requirements of the zone for which it is specified. A. P. Green plastic and castable furnace linings installed under the supervision of trained personnel give you the full benefit of monolithic construction, plus the advantages of "zone-rated" materials.

SUPER HYBOND is a special super duty plastic that develops high strength throughout its entire thickness . . . regardless of furnace operating temperature. It is ideal for use in spreader stoker arches and piers, behind waterwall tubes, and as a seal around tubes where they pass through the wall.

SUPER-PLASTIC . . . a super duty plastic designed for use where operating conditions are unusually severe. Gives excellent service in complete monolithic linings, side walls in furnace area, flat suspended arches and spreader stoker arches. Patching and repairing firebrick or plastic linings with SUPER-PLASTIC results in longer, more efficient service.

PLASTIC QUIK-PAK . . . a high duty plastic refractory which combines refractoriness, low shrinkage and hot load bearing strength. It is used in constructing monolithic side walls and in patching those portions of watertube boiler linings which do not require super duty plastic.

KAST-SET is a high quality refractory castable which develops a strong hydraulic bond without application of heat. Recommended for convection sections of watertube boilers, baffles, waterwall backing, linings for stacks, breechings, flues, and ducts.

KAST-O-LITE is a lightweight, insulating castable refractory for temperatures up to 2500° F. Used for monolithic linings in convection sections of boilers. Reduces heat loss. Insures closer temperature distribution and control.

For properly engineered monolithic linings call your A. P. Green distributor —he's listed in the yellow pages of your telephone directory.

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In Canada: A. P. GREEN FIRE BRICK COMPANY, LTD.
Toronto 15, Ontario

DISTRIBUTORS IN THE PRINCIPAL CITIES OF THE WORLD

Costs Less Because
It Gives the Most in Service

When selecting unions it will pay you to remember 2 things: (1) Darts can be used over and over again — on location after location (2) On location after location, they give a drop-tight seal. How can you beat this combination for economy . . . at any price?

QUICK FACTS

- Extra wide bronze seats resist pitting and corrosion
- Nut and body of air-refined, high test malleable iron are practically unbreakable
- Heavy shoulders can withstand the toughest wrench abuse
- Each Dart is individually vacuum-tested

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co., General Distributing Agents
Boston • New York • Pittsburgh • Rome, Ga.

DART UNIONS

CALL YOUR LOCAL DISTRIBUTOR FOR PROMPT DELIVERY OF DART UNIONS

More EQUIPMENT NEWS

Begins on page 162

self-aligning pillow block bearings permitting placing of unit on side wall or ceiling; and wide variety of drive arrangements to suit all industrial needs.

Draco Corp, Harvard Ave at E 116th St, Cleveland 5, Ohio

Portable air compressors

416 • High pressure, lightweight air compressors are designed for pressurizing hydraulic accumulators to any required pressure to 3000 psi. Available with electric motor or gasoline engine power source, units are suited to high pressure pneumatics for industrial application. The *32 Series* includes 2 models that provide 0.6 cfm of free air and have rated discharge pressure of 2500 psi. These units weigh less than 50 lbs complete with power source. The *130 Series* includes 2 models that will deliver 2 cfm of free air at rated discharge pressure of 3000 psi.

The Cornelius Co, 550 39th Ave NE, Minneapolis 21, Minnesota

For more data on these items, use post cards p 171. Identify your request with item number.

Teflon fibre yarn packing

423 • *Teflon* yarn packing is designed to function at higher peripheral speeds than ordinary braided tape or molded forms of *Teflon*. Antifrictional properties of *Teflon* combined with softness, resilience and fluid retentive properties of fine fibre construction are claimed to enable packing to run substantially cooler than other types. It is recommended for rugged and corrosive service on pump shafts and valve stems. Available sizes are ⅛ through ⅝ in., 1/16-in. graduations. Details on request.

Crane Packing Company, Dept PRN, 1800 Cuyler Ave, Chicago 13, Ill.

Packing for liquid caustics

437 • *White-Lon Style 322* is a mechanical packing designed exclusively for liquid caustics. Recommended use is for stainless steel or chrome plated pump shafts to form a tight seal against strong alkalies such as sodium, potassium, barium, ammonium, or magnesium hydrozides.

A W Chesterton Co, Everett, Mass.

Geared joint units

431 • Geared joint transmits power by a system of bevel gearing. Unlike a universal joint, this device has no maximum angle of operation. Primary use is for making sharp

(*Continued on page* 192)

Test Chamber . . . *unique facilities can duplicate any operating conditions for industrial insulations*

All kinds of insulated constructions can be tested under controlled interior and exterior temperature and humidity conditions in this new Armstrong laboratory building. Almost any service condition can be exactly duplicated.

The large circular chamber can be held at temperatures ranging from 0° to 160° F., with humidities accurately controlled from dry to practically saturated conditions. Complete test rooms are then built inside this controlled chamber and operated at temperatures from 100° below zero to 200° F. This flexible arrangement permits accurate control of conditions on both sides of an insulated wall.

This Armstrong laboratory building is just one tool constantly being used in a continuous program of research . . . a program that is steadily improving insulation materials and techniques used in applying them.

If you would like help in the solution of an insulation problem—or full details on the Armstrong Line of industrial insulations and Contract Service—call your nearest Armstrong office or write Armstrong Cork Company, 207 Stratton Street, Lancaster, Penna.

To test insulating specifications on various wall constructions, insulations are applied to a test room within the large circular chamber. Temperatures and humidities on both sides of the wall can duplicate almost any set of conditions.

Armstrong INDUSTRIAL INSULATIONS

The fuel that sparked our nation's growth secures her greater future

A young America—primed by a new and power-packed fuel—became a great industrial giant almost overnight. Coal had supplied the first unwavering spark which was to grow into the brightest productive flame the world has ever known.

After being served so well in the past and present, America looks again to dynamic coal for greater prosperity and security in the future. The vast Bituminous fields along the Baltimore & Ohio contain excellent coals in wide variety—available for centuries to come.

BITUMINOUS COALS FOR EVERY PURPOSE

Highly mechanized mines, equipped and ready for any demands, will help maintain long-range cost stability. And improved utilization methods will meet the increased requirements of the future by providing greater coal-burning efficiency.

CALL ON OUR COAL TECHNICAL SERVICE

You'll receive complete information from trained B&O experts about the kind and size of Bituminous coal that fits your needs best—at a price you want to pay. Write:

COAL TRAFFIC DEPARTMENT
BALTIMORE & OHIO RAILROAD
BALTIMORE 1, MARYLAND

LINKED TO 13 GREAT STATES BUILT THE NATION B&O

Baltimore & Ohio Railroad

Constantly *doing things*—better!

Detroit Edison Plant boosts U.S. Electrical Capacity to 100,000,000 KW.

Detroit Edison's St. Clair plant boosts U. S. generating capacity to a new high. The latest St. Clair unit, rated at 156,250 kw., to go on the line brought the total U. S. electrical capacity to over 100 million kw. Shell Turbo Oil 27 was purchased as the lubricant for this unit as well as for the other three turbine generators in this plant.

Shell Oil Company extends heartiest congratulations to Detroit Edison Company for their part in achieving this industry milestone in electrical power.

Shell is proud of its long association with the great electrical industry.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

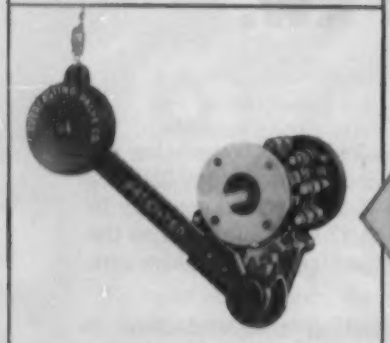
SHELL

For Everlasting Protection in Emergencies

OPENING TYPE

to divert water to sprinkler deluge or water curtain systems, or to divert inflammable liquids to a point of safety.

Write for Bulletin E52C



CLOSING TYPE

to shut off the flow of inflammable liquids or to concentrate water or steam in fire mains.

Both types can be controlled thermostatically, electrically, or manually from any or many locations. Their design assures positive, dependable protection because they do not wedge and consequently cannot stick.

EVERLASTING Valves

EVERLASTING VALVE CO.
45 FISK STREET, JERSEY CITY 5, N. J.

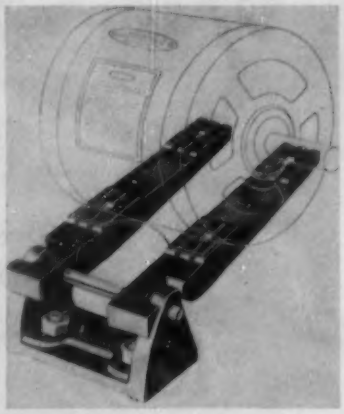
EV201

MORE EQUIPMENT NEWS

Begins on page 162

bends with flexible shaft or reach rod remote controls for valves. Unit is available in three sizes with maximum recommended operating torque from 500 to 3500 lb. in.

Stow Manufacturing Company, 181 Shear St, Binghamton, N. Y.

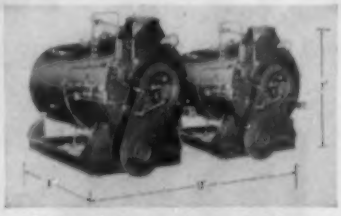


Pivoted motor base

442 • Automatic tension pivoted motor base, designed for use with either flat or V-belt drives, is available in 4 sizes for motor frames from 1/6 to 7½ hp. Modern construction is said to eliminate all manual adjustments and maintain exact belt tension for all load conditions. Belts can be changed without disturbing motor mounting. Base automatically takes up for belt stretch, and requires no maintenance, manufacturer states. Full details on request.

Rockwood Pulley Mfg Co, Inc, 20 Crosby St, New York 13, N. Y.

For more data on these items, use post cards p 171. Identify your request with item number.



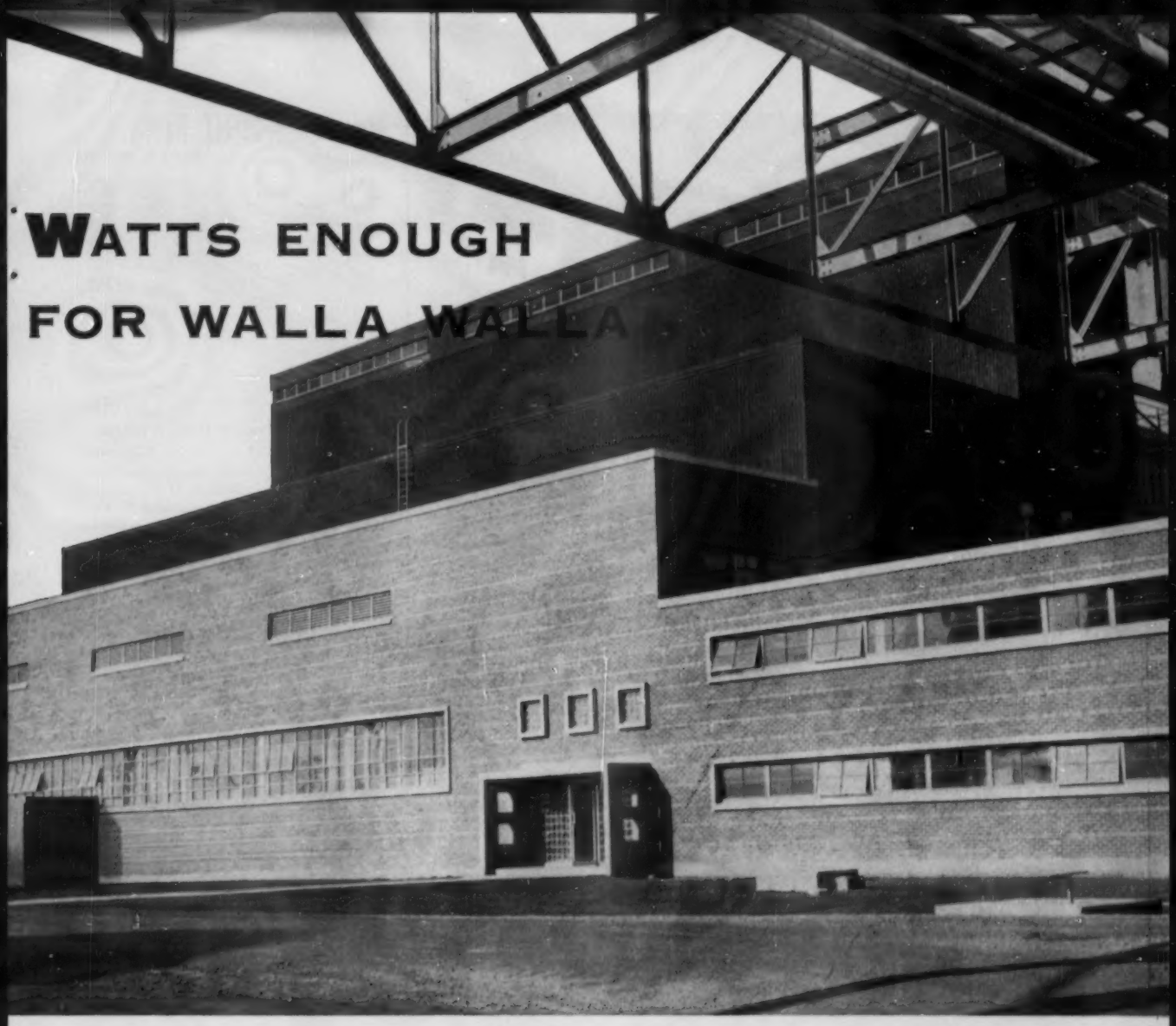
Twin-unit package boilers

441 • Utilizing only 104 sq ft of floor area and only 728 cu ft of plant space, twin-unit package boiler installation delivers 10,000 lbs of steam per hr. Furnished with modulating equipment, units can economically produce steam at 1/3 rated capacity, or 1300 lbs steam per hr. In this way, twin-package can handle fluctuating loads from 1300 lbs per hr to full 10,000 lb maximum with no lag in steam production throughout cycling range and no loss of efficiency. Operating pressures are available to 200 psi.

Equipped with variable capacity burner nozzles, units burn oil, gas, or a combination of the two. Details on request.

Cyclotherm div, U.S. Radiator Corporation, Oswego 2, New York

(*More Equipment News on p* 194)



WATTS ENOUGH FOR WALLA WALLA

This power plant could furnish utilities for a city the size of Walla Walla, Washington, with watts to spare. Its 12,000 kw. generating capacity supplies electricity for all of the facilities of the National Petro-Chemicals Corporation's Tuscola, Illinois installation. Three boilers feature economical, exterior installation, produce 600,000 pounds of steam per hour.

The plant was designed, engineered and built by Pritchard . . . under the popular Pritchard Single Responsibility Contract . . . working with the company's staff.

When you plan for construction, modernization or expansion of your power plant, take advantage of Pritchard's proved ability and complete facilities. Write today for complete information.

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ENGINEERS • CONSTRUCTORS

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THE BRAIDED PACKING INNOVATION OF THE MODERN AGE

Buy it

From your nearest Belmont Distributor

It's here now — ready to serve your needs — Belmont Crisscross Braid — acclaimed by packing users as the greatest braided packing advance in history.

This packing is new in design and construction. Each strand runs diagonally through the packing body at a 45 degree angle, unifying all strands into one complete packing structure which controls porosity while in service.

Belmont Crisscross Incorporates these Important Advantages

- will not *Unravel, Slough Off* or *Wear Through*
- gives you greater *Flexibility* without distortion in forming rings
- the lubrication is *Locked-In*
- its braided structure assures uniform *Controlled Porosity*
- you get *longer service life* because the solid integral braid results in a *stronger finished packing.*

When it *SEALS* right — stays TIGHT . . . you know it's Belmont made.

CLIP and Send Coupon 4-R-1

BELMONT PACKINGS

Butler & Sepviva Streets **Philadelphia 37, Pa.**

Without obligation — send us information as checked:

- ☐ Crisscross Braid Folder
- ☐ #54 Condensed Catalog
- ☐ #40 Catalog

Name ..... Title .....

Company .....

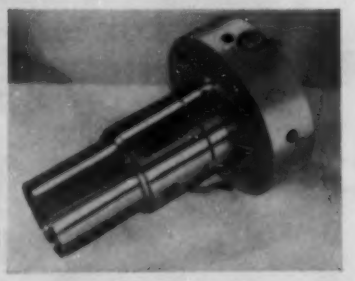
Address .....

City ..... State .....

☐ **SEND NAME and ADDRESS of NEAREST BELMONT DISTRIBUTOR**

More EQUIPMENT NEWS

Begins on page 162

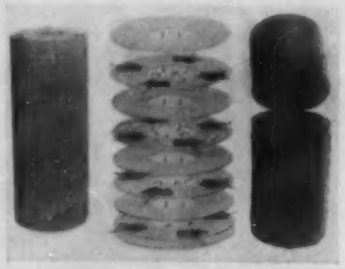


Seals for boiler feed pumps

424 • Mechanical seal for high pressure boiler feed pumps is claimed to stop liquid loss and reduce heat loss. It requires no operating adjustment. According to company, these units are now in operation in several high pressure, hot water pumping operations including temperatures to 430 F. Reports show that heat and liquid loss is minimized and frequent repacking problems are eliminated.

Byron Jackson Co, Box 2017, Terminal Annex, Los Angeles 54, Calif.

For more data on these items, use post cards p 171. Identify your request with item number.



Oil filter cartridges

427 • Cartridges feature large filtering area and are claimed to have low pressure drop and high dirt storage capacity. Density of filter paper used is said to result in removal of particle sizes down to 5 microns. Degree of initial particle size removal can be controlled by use of special papers and other materials where conditions require such control. Made of cellulose, these cartridges are suitable for filtering straight mineral oil or heavy duty detergent oils without removing detergents and oxidation inhibitors. Request bulletin F-278 for further information.

The Hilliard Corp, Purifier div, W 4th St, Elmira, New York

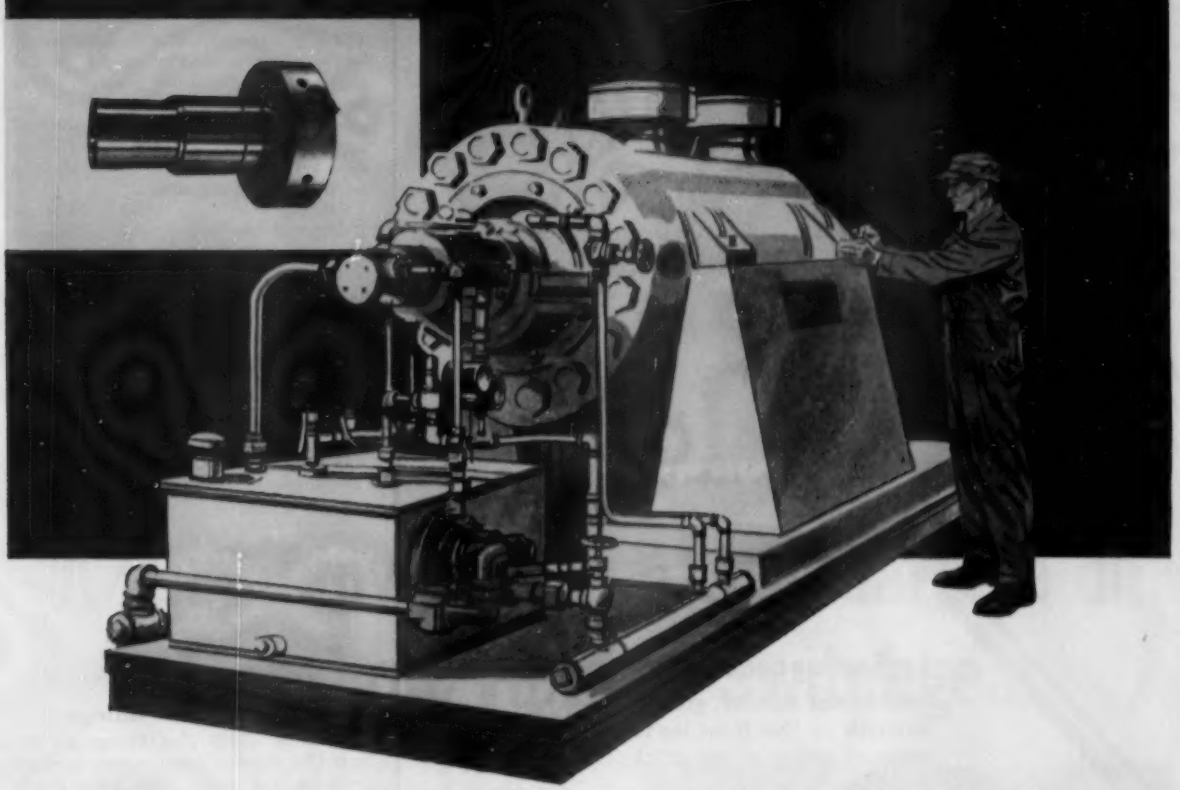
Black anti-rust paint

443 • Anti-rust paint is recommended for use on gutters, downspouts, stacks, flashings, railings, machinery, tanks and other exterior metal surfaces. It incorporates a bituminous base with special paint vehicle to produce a heavily bodied coating. Called *CI-88*, it dries to a semi-gloss and is intended as a finish coating. One application is said to be sufficient for most surfaces.

Chem Industrial Co, 3784 Ridge Road, Brooklyn 9, Ohio

(*More Equipment News on* p 196)

Now... BJ mechanical seals for high pressure boiler feed pumps!



Another Byron Jackson first!

- **No operating adjustment**
- **Stop liquid loss**
- **Reduce heat loss**
- **Save downtime costs**
- **Cut replacement costs**

BJ... the pacemaker in mechanical seals for pumps ... now has pioneered the first successful application of the mechanical seal to high pressure boiler feed pumps. These new BJ Mechanical Seals are now in operation in a number of high pressure, hot water pumping operations, including temperature up to 430° F. These seals—some in service as long as three years—have paid off in performance. They have minimized heat and liquid loss, eliminated frequent repacking problems, and simplified maintenance since no operating adjustment is required. Find out how these new BJ Mechanical Seals for boiler feed pump service can benefit you. Contact your nearby Byron Jackson office or write.

You'll do better with BJ

Byron Jackson Co.

Since 1872

P. O. BOX 2017, TERMINAL ANNEX, LOS ANGELES 54, CALIFORNIA

New RIDGID 200 Tripod Power Drive

with SPEEDCHUCK

Light Weight...
Easily Quickly Set Up...
Built-In Folding Tool Tray and Folding Legs

Power for any hand pipe tools — ⅛″ to 2″ pipe, ¼″ to 2″ bolts; geared tools to 12″.

Pats. Applied For

Leg Spacing and Tool Tray assure solid rigidity, greater strength . . . No front leg to obstruct swing of die stock handles.

Fast Easy Chucking, new principle—guaranteed to grip tight both forward and reverse, won't slip, even with geared tools . . . 3-jaw centering device turns with pipe . . . Extra-powerful motor, larger brushes, longer commutator.

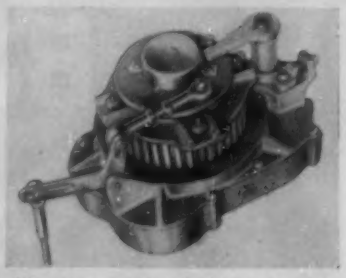
Your Supply House has it—
ready to demonstrate and expedite your order.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

RIDGID
Work-Saver Pipe Tools

More EQUIPMENT NEWS

Begins on page 162



Electro-mechanical governor

452 • Governor is an electro-mechanical load-sensing type used to control speed of gas or diesel engine-driven generators. Unit has two main functions—to control frequency of engine-driven ac alternators and to regulate voltage of dc machines. Both functions are accomplished by controlling speed of the prime mover.

Governor is normally driven from engine timing shaft through a set of spur gears that reduce speed of the rotating element to 150 rpm. Adapter pads are used to fit unit to any type gas or diesel engine. Bulletin T-8500 obtainable on request.

Inet Div of Leach Corp, 4441 Santa Fe Ave, Los Angeles, Calif.

For more data on these items, use post cards p 171. Identify your request with item number.

Stainless steel fittings

421 • New 150-lb pipe fittings are designed for standard pressure services where corrosion is a factor. They are available as screw-end and socket-welding units in stainless steel Type 304 and Type 316. Sizes range from ⅛ to 2 in.

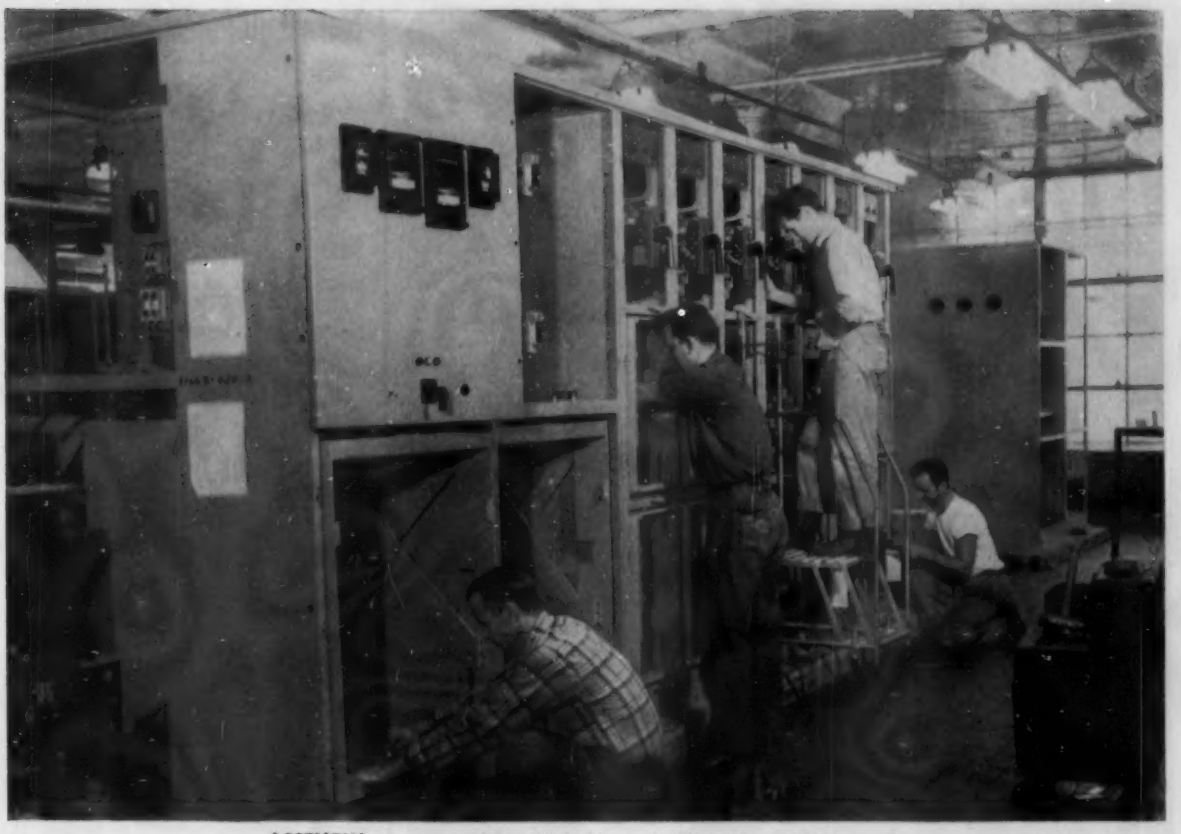
Type 304 stainless steel, with chromium content of 18% and nickel 8% is said to be highly resistant to corrosion and high temperature oxidation.

Type 316 stainless steel has a chromium content of 18%, nickel 11% and molybdenum 2½%. The higher nickel content and addition of molybdenum increase corrosion resistance in a variety of service.

Watson-Stillman Fittings div, H K Porter Company, Inc, 342 Madison Ave, New York 17, N. Y.

Cable trough system

418 • Expanded metal trough is designed to support runs of power, control and signal cables in industrial plants and generating stations. New *70,000 Series* trough is constructed with built-in pin type couplers at each opening. These permit sections to be permanently and securely joined in a mat-



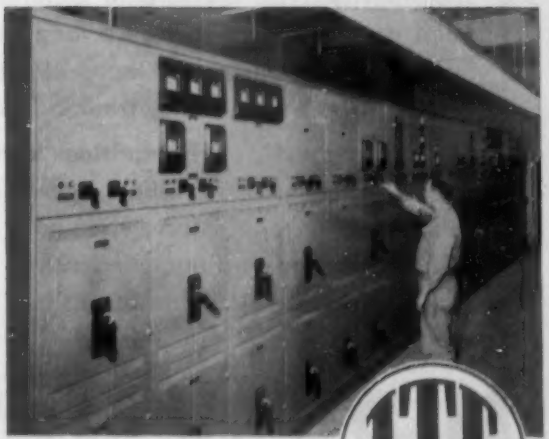
ASSEMBLY—In process of assembly is this standard low voltage switchgear unit.

A sound investment—standardize on I-T-E Low Voltage Switchgear

Before you specify low voltage switchgear, check the advantages offered by I-T-E. It is the finest of modern switchgear—factory assembled; shipped as a unit; ready to install; providing the maximum in dependability, safety, reduced maintenance costs, and attractive appearance.

I-T-E Circuit Breakers are the heart of the gear. Their performance in providing maximum protection has been proved conclusively in thousands of installations. I-T-E Structures are designed specifically to house and interconnect these time-tested protective devices and auxiliary equipment. When you combine the two, you get the finest of circuit breakers in the finest of structures—with much less special engineering, much faster delivery, and units tailor-made in standard frames to fit your requirements.

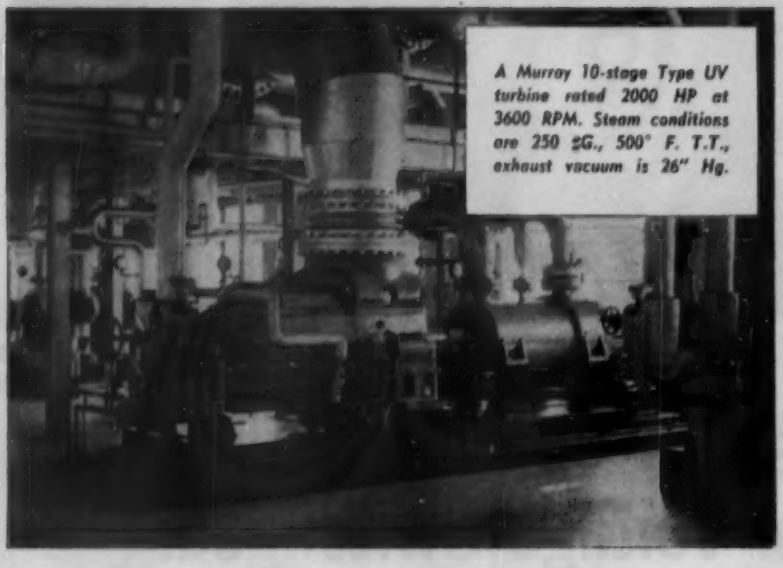
Standard I-T-E Low Voltage Switchgear Assemblies are available with ratings through 6000 amp continuous and 100,000 amp interrupting, 600 v a-c and 250 v d-c. For details, contact the I-T-E field office nearest you. Look in your classified directory under Electric Equipment, or write for Bulletin 6004A. I-T-E Circuit Breaker Company, Switchgear Division, 19th and Hamilton Sts., Philadelphia 30, Pa.



INSTALLED—A standard I-T-E low voltage switchgear unit in operation.

I-T-E CIRCUIT BREAKER COMPANY, Switchgear Division

Murray Turbines



A Murray 10-stage Type UV turbine rated 2000 HP at 3600 RPM. Steam conditions are 250 #G., 500° F. T.T., exhaust vacuum is 26" Hg.

● The Murray Type UV turbine pictured above has been driving a high pressure lean oil pump in a Southwestern refinery for the past 10 years. And is still giving dependable, trouble-free service.

Murray mechanical drive turbines both single and multi-stage can be furnished in a wide range of ratings for steam pressures ranging from 0 to 600 #G., condensing and non-condensing. Types in the higher pressures available for up to 250 #G. back pressure.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

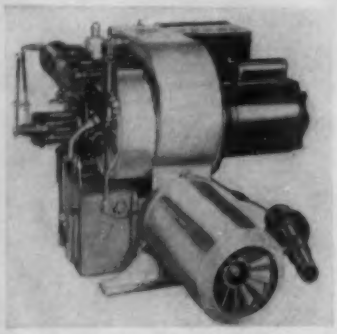
More EQUIPMENT NEWS

Begins on page 162

ter of seconds, manufacturer states. Lengths of 8, 10 and 12 ft will be available. For further information request bulletin 67A.
T J Cope, Inc, 711 S 50th St, Philadelphia 43, Pennsylvania

Due to a printer's error

the following item, p 188, March, POWER, was incorrectly set. The item appears below in its correct form.



Low-pressure oil burner

350 • Unit is designed for installation in small industrial, commercial and institutional buildings having a net standard radiation to 3800 sq ft or 35 boiler hp. The pressure-air atomizing type burner with all electric ignition is capable of burning 11 gallons of oil per hour.

Manufacturer states the packaged unit is inexpensive to install since no front plates, secondary air door or checker work hearth is needed, all primary and secondary air being furnished by the burner. It is designed to burn low cost No. 4 or No. 5 heavy oil without preheating.
Cleaver-Brooks Co, 326 E Keefe Ave, Milwaukee 12, Wisconsin

CORRECTION

New product item No. 313, p 172, March POWER, gave the address of Pennsylvania Pump and Compressor Company as Erie, Pa. This should be Easton, Pa.

S W Brown, former chief engineer of the marine dept of Carrier Corp, has opened his own business as a consulting engineer. The firm, located in the Chrysler Bldg, New York City, will specialize in design and application of air-conditioning and refrigeration systems.

Nine additional companies have been admitted as members of the Atomic Power Development Associates. Expansion of the project brings the number of associated companies to 34.

India will use $3,300,000 of Canadian Colombo Plan aid to help build a hydroelectric project on the Umtru River, Assam.

County Courthouse, Newkirk, Oklahoma

Where does the Court get its power?

For seven years in Newkirk, Oklahoma, one powerful machine controlled the power of the court...a Fulton 800 H.P. dual-fuel generating unit, lubricated by Cities Service Pacemaker #5 Oil.

But it wasn't only the court that depended upon this one machine . . . the entire town relied upon it. If the machine failed, so might the annual grain harvest, for Newkirk's grain elevators require great quantities of power.

BUT THE FULTON GENERATING UNIT AND CITIES SERVICE LUBRICATION PROVIDED FAULTLESS SERVICE. There was never a breakdown.

Newkirk's power boss, Superintendent of Utilities Ralph E. Cottrell, sums it up this way: "Using Pacemaker #5 in the engine's crankcase and cylinder lubricators, we not only enjoyed trouble-free operation during those seven years, but also surprisingly little wear and oil consumption. Rings, bearings and liners remained in top notch condition and the engine piled up well in excess of 6000 horsepower hours per gallon of oil."

This is but one more powerful story of Cities Service Lubrication . . . a graphic illustration of the kind of results you can expect from these highest quality lubricants. Why not get the whole story from a Cities Service Lubrication Engineer? Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

Ralph E. Cottrell, Power Boss of Newkirk, Oklahoma. All of Newkirk depends on him as Supt. of Utilities. He depends on Cities Service Lubricants for town's power generators.

Powerful Machine Behind The Court is this Fulton 800 H.P. dual-fuel generating unit. For seven years Newkirk's only major power source, it gave "faultless performance" using Cities Service Lubricants.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Now stocked at all Garlock Branch Warehouses

CONTACT THE GARLOCK BRANCH NEAREST YOU

Yes, now you can obtain Garlock O-Rings direct from our branch warehouse nearest you. Each of our warehouses stocks 70 durometer rubber O-Rings in all popular standard sizes. For you this reduces delivery time to a minimum.

You can rely on Garlock O-Rings, too. They're made to Garlock's rigid quality standards. This means O-Rings with precise tolerances, a flash-free finish, and utmost uniformity.

For complete information, just contact your Garlock office or write for new O-Ring folder AD-148.

Baltimore, Md.
Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Houston, Texas
Los Angeles, Calif.
New Orleans, La.
New York, N. Y.
Palmyra, N. Y.
Philadelphia, Pa.
Pittsburgh, Pa.
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THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK

BOOKSHELF

Introduction to Atomic Physics (*Second edition*). *By Otto Oldenberg, professor of physics, Harvard University. 6x9, 421 pp, illus, tables, $6.00. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y.*

Guiding idea of this book is to train the student to understand and judge atomic theory, rather than to accept it on authority. Wherever possible, the historical approach is used by discussing history of the great discoveries. Theories that belong to more advanced courses are only briefly reported. The book is divided into several parts headed as follows: structure of matter as revealed in chemistry, gases, structure of electricity, structure of light, electronic structure of atoms, nuclear structure, wave nature of matter.

The author assumes that the reader has had a one-year course in introductory physics and is familiar with the elements of chemistry. The book emphasizes the relation between theory and observed facts.

Manual of Mathematics (*Revised edition*). *3¾x6¾, 334 pp, loose-leaf, 1-in. metal-ring binder, imitation leather, tabbed indexes, $4.25 (sheets in 2-pin binder, $2.25).* LEFAX, *Sheridan Bldg, 9th and Sansom Sts, Philadelphia 7, Pa.*

This collection of loose-leaf data sheets is divided into five main sections: mathematical reviews; logarithms of numbers; natural trigonometric functions; squares, cubes, square roots, etc; circles and spheres. The first section contains more than 200 equations on algebra, analytical geometry, trigonometry, calculus. In addition there are sheets on curve formulas, theory of errors, centers of gravity.

The second section includes a table of six-place logarithms of numbers, anti-logarithms of numbers, six-place logs of trigonometric functions. The third section has extensive tables of natural sines, tangents, cotangents and cosines, as well as natural and logarithmic haversines and natural versed sines and exterior secants.

Tables in the fourth section give base numbers and corresponding circumference, circle areas, square, cube, square root, cube root, reciprocal, fifth roots and powers, two-thirds powers, decimal equivalents of fractions and of fractions of feet and inches. The last section gives tables for finding areas, volumes, surfaces, geometrical surfaces and solids.

Elementary Fluid Mechanics (*Third edition*). *By John K Vennard, professor of fluid mechanics, Stanford University. 5½x 8⅛, 401 pp, 214 illus, tables, $5.50. John Wiley & Sons, Inc, 440 4th Ave, New York 16, New York.*

Fluid mechanics studies fluids under all possible conditions of rest and motion. Analytical, rational and mathematical viewpoints are used rather than empirical. The book begins with a discussion of fundamental physical properties of fluids and fluid statics. Broad concepts and principles of fluid flow show its relationship to thermodynamics. The author covers fric-

NOW!

An Entirely New Method For Sizing Controls!

BS&B's New, Exclusive Method Takes Both The GUESS And The WORK Out Of Controls Sizing For Liquid, Steam And Gas Applications!

Today's modern and complex processing systems require accurate control valve sizing. No one has recognized this fact more than BS&B.

Therefore, as a service to industry, BS&B set out to develop a new, simple, more accurate method of sizing controls. Here it is in the new BS&B Controls Sizing Manual.

This new, exclusive method uses two new "tools" to make sizing more accurate—the SIZE-O-GRAPH to determine what the valve MUST do and Cv RATINGS to determine what the valve WILL do.

These "tools" are based upon thousands of hydraulic flow tests performed on all sizes and types of BS&B Controls in the industry's largest and most modern flow testing laboratory. Results are proven by correlation with *actual* gas and steam flow tests.

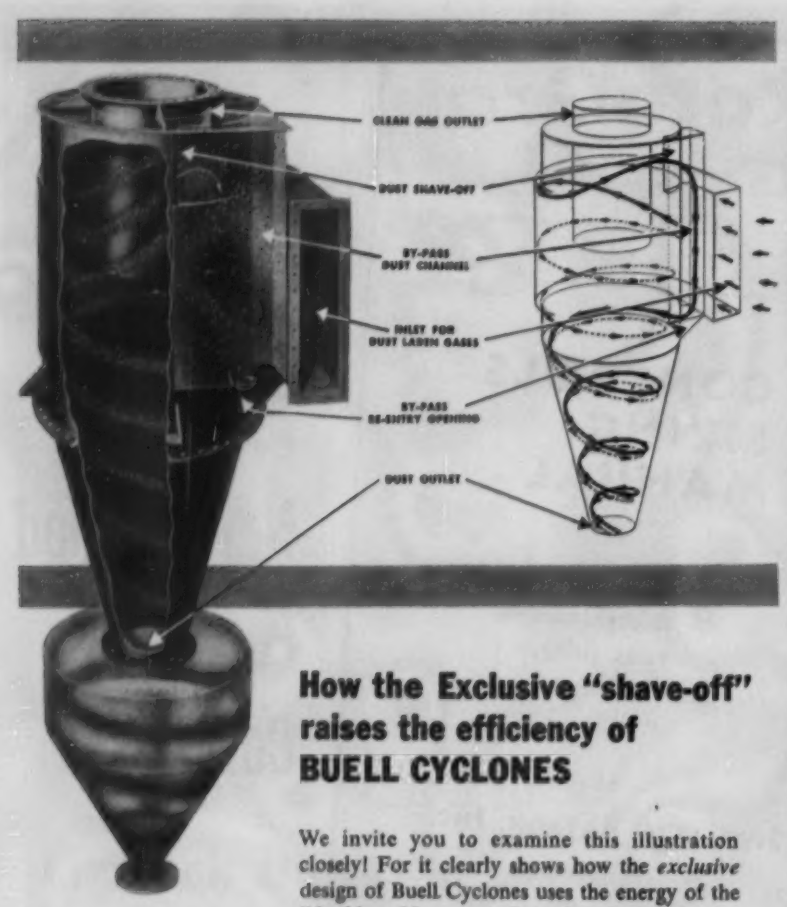
If you'd like a copy of this new manual, write to . . .

OVER 60 YEARS — EXCELLENCE — BS&B — RELIABILITY

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Controls Division, Dept. 4-Q4
7500 East 12th Street, Kansas City 26, Missouri



How the Exclusive "shave-off" raises the efficiency of BUELL CYCLONES

We invite you to examine this illustration closely! For it clearly shows how the *exclusive* design of Buell Cyclones uses the energy of the "double eddy current" to increase collection efficiency.

Black arrows indicate how the upward spiral of dust is caught by the patented "shave-off" and by-passed down to the lower part of the cyclone. Here the downward flow of the lower half of the "double eddy current" forces it to the discharge. Result: high level of efficiency no other mechanical cyclone can offer!

Large diameter design for clog-free operation! Extra heavy gauge metal wall for long life! It will pay you to get *all* the facts about Buell Cyclones! Write for free booklet—The Collection and Recovery of Industrial Dusts—which explains *all three* Buell systems. Dept. 50-D, Buell Engineering Company, 70 Pine St., New York 5, N. Y.

For positive material flow specify BUELL PMF Hopper Valves!

...consists of an upper and lower valve which are alternately opened by a motor-driven cam. Unique self-cleaning features make it suitable for the toughest applications.

buell

MECHANICAL ELECTRICAL *20 Years of Engineered Efficiency in* **DUST COLLECTION SYSTEMS**

More BOOKSHELF

Begins on page 200

tionless fluid flow for both incompressible and compressible fluids and develops the impulse-momentum principle. Descriptions of frictional processes, similitude and dimensional analysis complete the tools the beginning student needs to tackle applications. Conditions studied include pipes, open channels, measuring devices and flow about immersed objects.

ASTM Manual on Industrial Water. *Prepared by committee D-19, American Society for Testing Materials. 6x9, cloth, 430 pp. $5. ASTM, 1916 Race St, Philadelphia, Pa.*

This manual offers a broad discussion of the nature and uses of industrial water. It contains up-to-date test methods and specifications developed by leading authorities in the field.

Chapters cover uses of industrial water, difficulties caused by water in industry, water composition, composition of water-formed deposits, industrial-water treatment, sampling, analysis, and identification of water-formed deposits.

Conveyors and Related Equipment. *(Third Edition). By Wilbur G Hudson, M.E., American Society of Mechanical Engineers. 6x9, 524 pp, $9. John Wiley & Sons, Inc, 440 4th Ave, New York 16, N. Y.*

A new edition of a widely-used book completely covers the field of materials handling and related equipment.

New material featured in this edition includes developments of the last three years in belt construction and dynamic drive control; 1954 costs and designs of silos, bins and bunkers; dust explosion hazards; developments in boiler house coal handling and storage; developments in pneumatic conveying; hydraulic transportation of coal in pipelines; and recent expansions in the applications of motorized industrial trucks made possible through development of the two-way radio.

National Fire Codes *(1954 edition). Six volumes, $6. per volume. National Fire Protection Association, Publications Dept, 60 Batterymarch St, Boston 10, Mass.*

All standards in this latest edition have been completely revised as of July 30, 1954. The codes have been enlarged to six volumes for the first time, with addition of the new Transportation volume, No. VI, containing 21 fire safety standards for air, marine and highway transportation, in 424 pages.

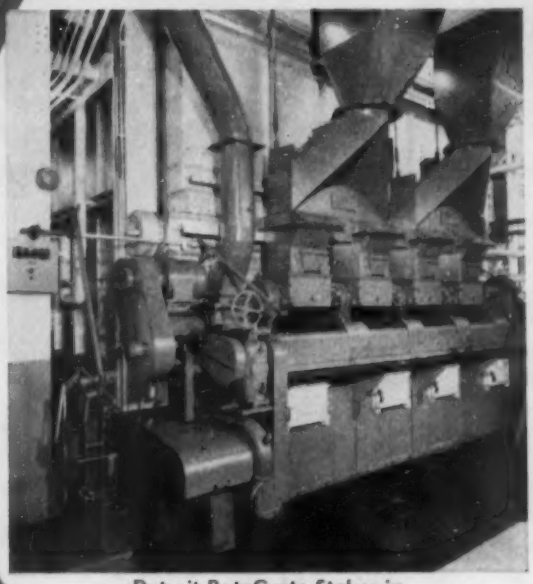
The other five books are Vol. I, Flammable liquids and gases, 672 pages, 36 standards; Vol II, Combustible solids, dusts, chemicals and explosives, 512 pages, 33 standards; Vol. III, Building construction and equipment, 640 pages, 33 standards; Vol. IV, Extinguishing equipment, 640 pages, 32 standards; Vol. V, Electrical, National electrical code plus 6 other NFPA electrical standards, 672 pages.

The codes and standards are intended to provide reasonable safety to life and property, avoiding provisions involving inconvenience and expense not essential to reasonable fire safety. Standards are phrased in terms of performance or objec-

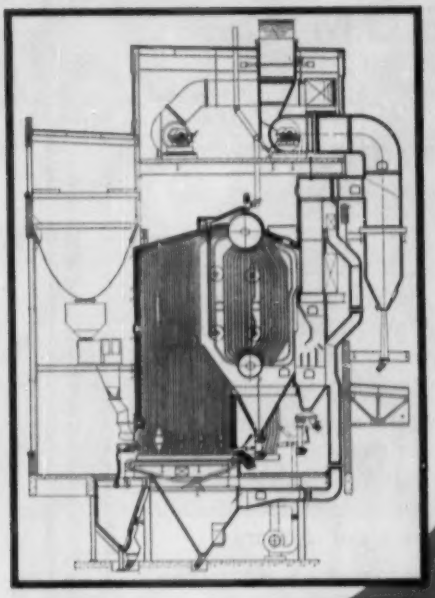
Detroit RotoGrate Stoker

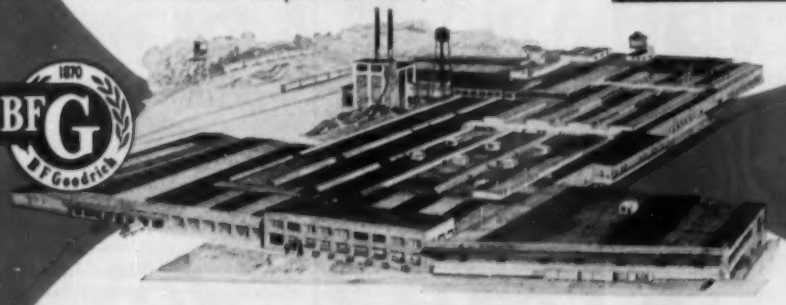
SELECTED FOR TIRE PLANT

The B. F. Goodrich Company, Oaks, Pa.



Detroit RotoGrate Stoker in
B. F. Goodrich plant at Oaks, Pa.





This Detroit RotoGrate Stoker is installed with a Wickes two drum Steam Generator, capacity 115,000 lbs. per hour at 300 psi and 440° F. Design is based on using 350° F preheated air, when burning Fairmont District West Virginia coal. This is part of an expansion program at this plant. Detroit RotoGrate is an advanced spreader stoker with specially designed overlapping grates that move slowly forward, discharging ash at the front. Any Bituminous coal or Lignite, and many types of refuse are successfully burned. High burning rates per square foot of grate and exceptional flexibility make this stoker popular. Detroit RotoGrate will save you money—improve your operation.

DETROIT STOKER COMPANY
GENERAL MOTORS BLDG.—DETROIT 2, MICH.
District Offices in Principal Cities • Works at Monroe, Mich.

DETROIT SINCE 1898 STOKERS

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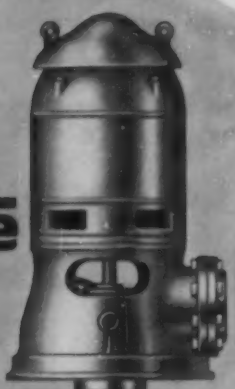

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Verti-Line Turbine Pumps are the result of almost half a century of experience in pump research, design, engineering, manufacturing.

Designed and engineered into every Verti-Line Pump are feature after feature that have been proven in-the-field to give better balanced performance and efficiency.

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More than 100,000 satisfied vertical pump users agree there's no pump like Verti-Line for low first cost, economical operation, and negligible maintenance.

Whatever your vertical pump needs — investigate Verti-Line before you buy.

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More BOOKSHELF

Begins on page 200

tives, permitting use of any methods, devices, or materials that will produce the desired results.

Although purely advisory as far as the National Fire Protection Association is concerned, the Codes are widely used as a basis of good practice by property owners and others, and for legal and insurance purposes in the U.S., Canada, and other countries. Many of them have been adopted and published by the National Board of Fire Underwriters, Dominion Board of Insurance Underwriters, and others.

Mechanical Refresher for Professional Engineers License. *By John Constance, P. E. 11x8½, paper, 112 pp; diagrams, tables, problems. $3. Published by author at 625 Hudson Terrace, Cliffside Park, N. J.*

Like its companions, this volume is helpful to candidates preparing for license examinations in various states. It will serve for either oral or written tests.

Subjects covered include vectors and forces, kinematics, friction, force and mass, plane curvilinear motion, work and energy, impulse and momentum, buoyancy and floatation, coiled springs, belts, gears, lubrication, bearings, flywheels, crankshafts, cylinders and keys.

Illustrative worked-out problems on these and related subjects are valuable aids for anyone expecting to take a professional or operating license exam.

Flow and Fan. *By C Harold Berry, professor of mechanical engineering, graduate school of engineering, Harvard University. 6x9, 226 pp, 84 illus, cloth, $4. The Industrial Press, 148 Lafayette St, New York 13, New York.*

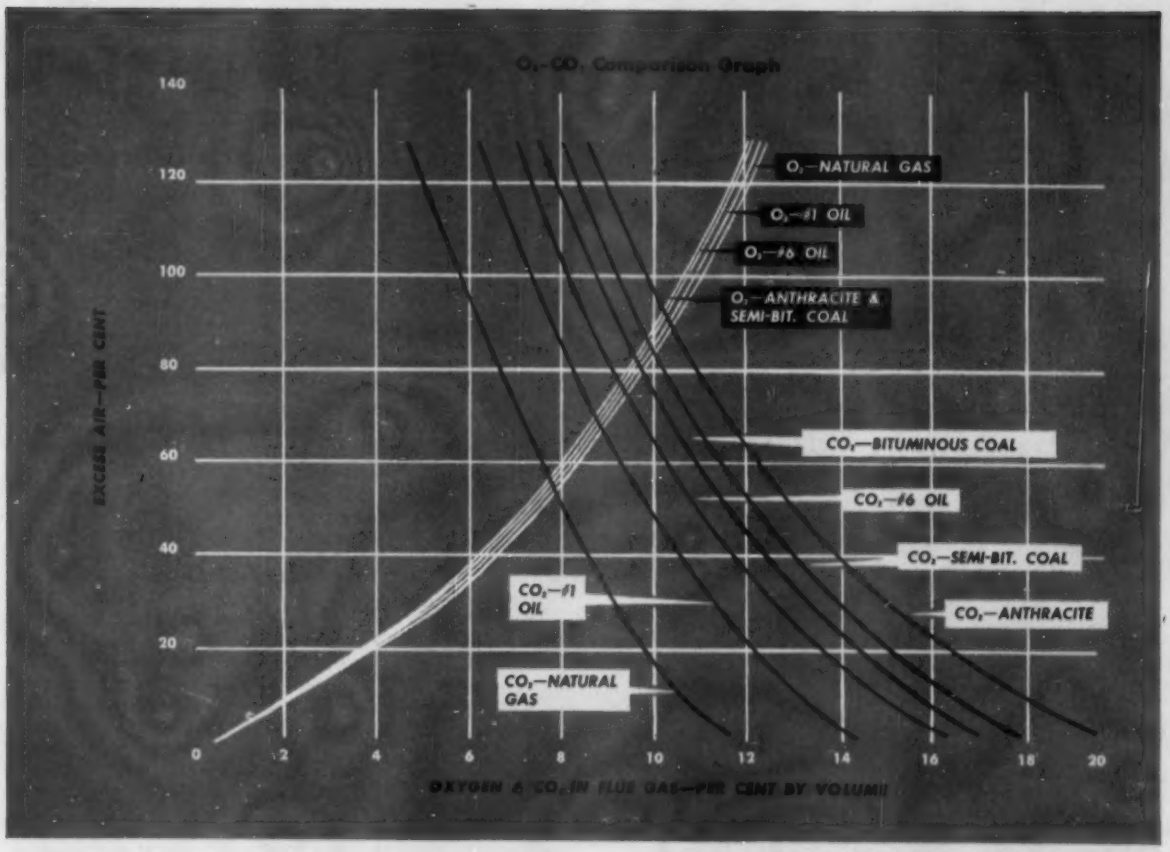
On many engineering jobs we must establish and maintain flow of air or other gas through a system of ducts by means of one or more fans, or by natural convection. The fan must do work upon the air at a rate balancing losses due to friction and other resistances.

This discussion presents a simple analysis of gas flow through ducts, intended to be applicable to ordinary engineering jobs where high precision is neither needed nor attainable. Subjects covered include factors in gas-flow measurement, pressure and loss calculations, losses in straight uniform ducts and diverging passages, effect of flow and fluid, fan performance, fan selection and rating, and fan operation and control.

1955

AWARD PROGRAM

Have you recently modernized any of your power services? Tell us about it. You may be in the 1955 award picture. See p 95



HOW TO BURN Multiple Fuels EFFICIENTLY

When switching from one fuel to another or burning more than one fuel at the same time, you can realize large savings with a continuous indication of Oxygen content in your flue gas—because Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

This fact is borne out by the graph showing the relationship of excess air to CO_2 and O_2 in the flue gas of five common fuels. While the O_2 curves nearly coincide (especially in the important 30% excess air range) the CO_2 curves diverge widely.

Large savings possible

This deviation was costing a medium sized refinery in Michigan $35-40 per day in boiler room fuel costs. Burning a combination of oil and gas they found that a combustion control system to handle their multiple fuel firing conditions would cost more than their small boilers.

With the purchase of a Hays Magno-Therm Oxygen Recorder, they found that they were able to reduce fuel costs enough *to pay for the instrument in 40 days.*

Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

If you are facing the problem of multiple fuel combustion, you will want a detailed copy of this O_2-CO_2 Comparison Graph as well as Hays Bulletin 52-829-56 — describing the Magno-Therm Oxygen Recorder. Write for this free information.

With the Hays Magno-Therm Oxygen Recorder you get:

- *Continuous, highly accurate indication and recording.*
- *Complete compensation for temperature and pressure effects.*
- *Freedom from chemicals or hazardous fuel burning in the analyzing process.*
- *Swift, sure electronic operation.*

Automatic Combustion Control
Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

THE hays CORPORATION

MICHIGAN CITY 3, INDIANA

LOCKED-IN LUBRICATION IMPORTANT FEATURE

OF R/M's BIG 7 PACKING TYPES

The lubricants in R/M's Big 7 Packing Types are ground in during manufacture—they are not just surface coatings. Heat can not dissipate them. Pressure can not force them out. They are locked in so securely that even after the packing starts to wear, the bearing surface remains the same. Superior lubrication, however, is but one of the many advantages of R/M's Big 7 Packing Types. By standardizing on this basic, custom-built line—you probably need only 3 or 4—you can reduce downtime, cut costs, lower inventories, simplify ordering. To find out how, ask your R/M distributor for the R/M Big 7 Recommendation Chart.

R/M's BIG 7 PACKING TYPES MEET 95% OF ALL PACKING NEEDS

R/M Packings for maintenance purposes are sold only through authorized R/M distributors

R/M BIG 7 PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks Clutch Facings • Fan Belts • Radiator Hose • Bowling Balls

APPOINTMENTS

Corporation executive changes

Sarco Co, Inc: H L Simmons, president and treasurer; R W Cumming and A Milnes, vice-presidents. **Sarcotherm Controls, Inc:** L Barfus, president and treasurer; R Stevens, vice-president. **Stone & Webster Engineering Corp:** Fred W Argue, vice-president. **Raybestos-Manhattan, Inc:** S R Zimmerman Jr, vice-president; R J Gorecki, director. **The Siegler Corp:** N E Grandt and W G Ullman, vice-presidents. **American Radiator & Standard Sanitary Corp:** W A Bauer, president of plumbing and heating div.

Westinghouse Electric Corp: John F Myers, vice-president. **Radio Receptor Co:** Hugo Cohn, president, succeeding L Arnson, retired. **The Chapman Valve Manufacturing Co:** David M McIntosh, executive vice-president. **Sylvania Electric Products Inc:** D G Mitchell, president. **Stephens-Adamson Manufacturing Co:** A D Sinden, vice-president.

D J Murray Manufacturing Co: W A Marquardt, assistant manager. **E F Houghton & Co:** J T Eaton, vice-president, production. **American District Steam Co, Inc:** J G Dobson, vice-president. **Borg-Warner Corp,** Pesco Products div: Robert G Hess, vice-president, operations. **Joy Manufacturing Co:** Louis G Helmick Jr, vice-president, manufacturing.

Operations executive changes

Moloney Electric Co: W C Reinhardt, supervisor for newly created engineering research & development laboratory. **Westinghouse Electric Corp:** George W Jernstedt, director of new manufacturing laboratory. **Walter Kidde Nuclear Laboratories, Inc:** Joseph Silverman, head of research department, laboratory div.

Worthington Corp: Aloysius M Tullo, general manager of Harrison div. **General Motors Corp:** S E Knudsen, general manager of Detroit diesel engine div. **Borg-Warner Corp:** J Zimmer, plant manager of Wausau Manufacturing Co, a subsidiary.

Engineer changes

Ric-wiL Inc: Bradlee Pruden, vice-president, engineering. **Marion Electrical Instrument Co:** F J Gaffney, vice-president, engineering. **Edward Valves, Inc:** B J Milleville, chief engineer. **Leeds & Northrup Co:** G L Broomell Jr, chief engineer.

Westinghouse Electric Corp: F R Benedict, manufacturing engineering manager for Sturtevant div. **Allis-Chalmers Manufacturing Co:** H W Cory, chief engineer of control engineering, Hawley works.

Norton Co: F B Huke, chief atomic

(*Continued on page* 210)

STAINLESS STEEL

...fights corrosion...solves many piping problems

● Stainless steel piping, using TUBE-TURN* Stainless Steel Welding Fittings, can provide long, safe service where corrosive gases or fluids are handled. Likewise, stainless steel systems are superior where temperature extremes are encountered, for handling dangerous materials safely, for preventing contamination.

Tube Turns offers a *complete line* of Stainless Steel Welding Fittings in three analyses: AISI Type 304, Type 347, and Type 316; and in four schedules: 5S and 10S (thin wall), and 40S and 80S (heavy wall). For the *right* stainless steel welding fittings, and for help in proper application, get in touch with your Tube Turns' Distributor. You'll find one in every principal city.

TUBE-TURN Welding Fittings and Flanges are made in U.S.A.
They meet all U.S. piping code specifications

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

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STAINLESS DATA

How you get *extra service* from TUBE-TURN* Stainless Steel Welding Fittings

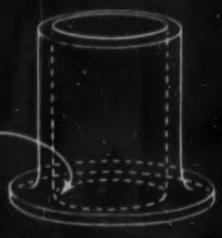
EXTRA-VALUE FEATURES AT NO EXTRA COST

UNIFORM WALL ASSURES UNIFORM STRENGTH

All TUBE-TURN Welding Elbows meet ASA B16.9 and MSS SP43 Standards on minimum wall thickness of 87½% of nominal thickness — particularly important on thin wall welding elbows. Many elbows on the market are as much as 30% to 40% below nominal thickness at this point of greatest wear. Wall thickness is likewise uniform on the inside radius — no "bunching up" of metal.

MATCHES PIPE BURSTING STRENGTH

Welding Tees are adequately reinforced. Along with other TUBE-TURN Welding Fittings their strength matches the calculated bursting strength of the pipe.



NO CORROSION POCKETS

TUBE-TURN Lap Joint Stub Ends have a square inside corner which eliminates a "corrosion pocket" and a proper fillet radius which assures strength under flexing and vibration.

CHECK THESE FEATURES
Only TUBE TURNS offers them all

- **Fittings meet standard chemistry specifications**
- **Minimum wall thickness of elbows 87½% of nominal**
- **Fittings meet minimum calculated bursting pressure of matching pipe**
- **Qualified welders and procedures used where welding is required**
- **Each fitting properly solution heat treated**
- **Each fitting passivated**
- **Other special grades of stainless steel, and all other alloys available**

All these extra value features available to you at no extra cost.

MEET ALL CODES

TUBE-TURN Stainless Steel Welding Fittings meet all specifications: ASTM A312 (for material); MSS SP43 and ASA B16.9 (for dimensions); and MSS SP25 (marking procedure).

TUBE TURNS, Dept. C-2
224 East Broadway, Louisville 1, Kentucky
Please send STAINLESS STEEL "WHY AND WHERE" book.

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Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____

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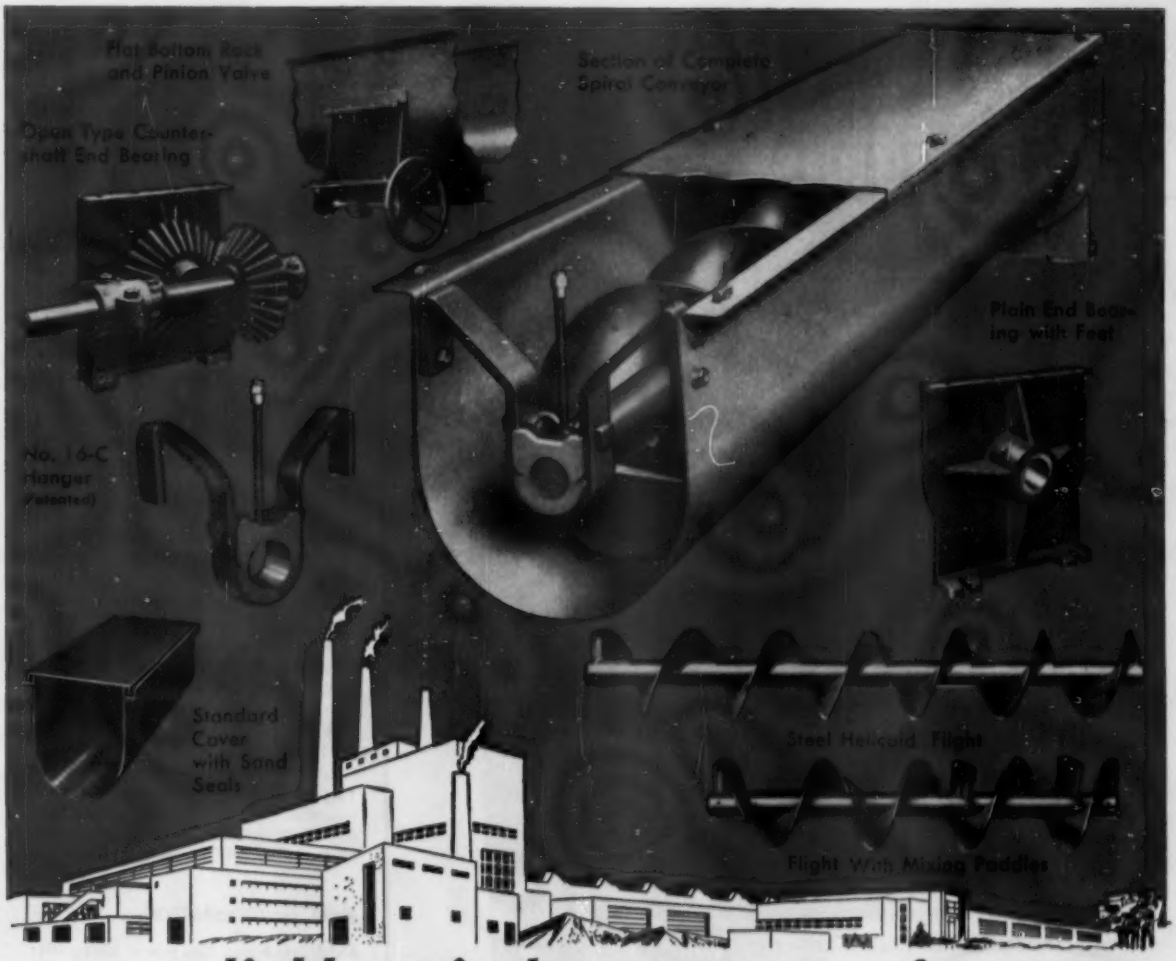
TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

LOUISVILLE 1, KENTUCKY


Flat Bottom Rack and Pinion Valve
Section of Complete Spiral Conveyor
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Plain End Bearing with Feet
No. 16-C Hanger (Patented)
Standard Cover with Sand Seals
Steel Helicoid Flight
Flight With Mixing Paddles

reliable spiral conveyor performance with JEFFREY INTERCHANGEABLE PARTS

"Down time" on a spiral conveyor costs you time and money. To help you lower both these expenses, Jeffrey maintains a healthy inventory of spiral conveyor flights, end and thrust bearings, hangers, covers, discharge openings, spouts, valves and other replacement parts.

A letter or phone call to our Merchandise Sales Division in Columbus or your nearest Jeffrey District Office or Jeffrey Distributor will get quick action. Immediate shipment of reliable Jeffrey interchangeable parts will put your spiral conveyor unit back in operation on the double. Better yet, don't wait for breakdowns, order a supply of essential Jeffrey replacements now.

Jeffrey builds all spiral conveyor components on equipment designed especially for that purpose. Uniform strength and true alignment result — every time. All flights and fittings conform to new industrial standards making them interchangeable with other standard makes.

For reliable performance, specify Jeffrey — whether the smallest renewal part or a new standard spiral conveyor engineered for your special needs.

Write for Spiral Conveyor Catalog 851.

THE JEFFREY MANUFACTURING CO.

ESTABLISHED 1877

Columbus 16, Ohio

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Water Conservation starts *here*

Take the first step toward efficient water utilization . . . use BUILDERS PROPELOFLO METERS to find out *where* water is used and *how much*. Address . . .
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More APPOINTMENTS

Begins on page 206

products engineer of refractories div. **The Swartwout Co:** J P Green, director of engineering. **Link-Belt Co:** R J Geitman, chief engineer for San Francisco plant. **Cleveland Fuel Equipment Co:** George A Short, chief engineer.

Consolidated Engineering Corp: A F DuFresne, chief product engineer; F T Greenup, chief design engineer. **American Engineering Co:** J W Tyler, staff engineer. **General Electric Co,** Carboloy dept: R J Studders, manager of magnetic products engineering. **Borg-Warner Corp:** C E Cooney Jr, chief engineer of mechanics universal joint div; John Polomski, chief engineer of products development laboratory. **Solar Aircraft Co:** Paul A Pitt, chief engineer.

New general sales managers

A M Byers Co: Harry R Rowland. **Union Asbestos & Rubber Co:** F B Kreider, fibrous products div. **Sola Electric Co:** Nelson P Marshall. **The Cooper-Bessemer Corp:** Robert F Lay. **Tann Corp:** W M Smart, Congress Drives div.

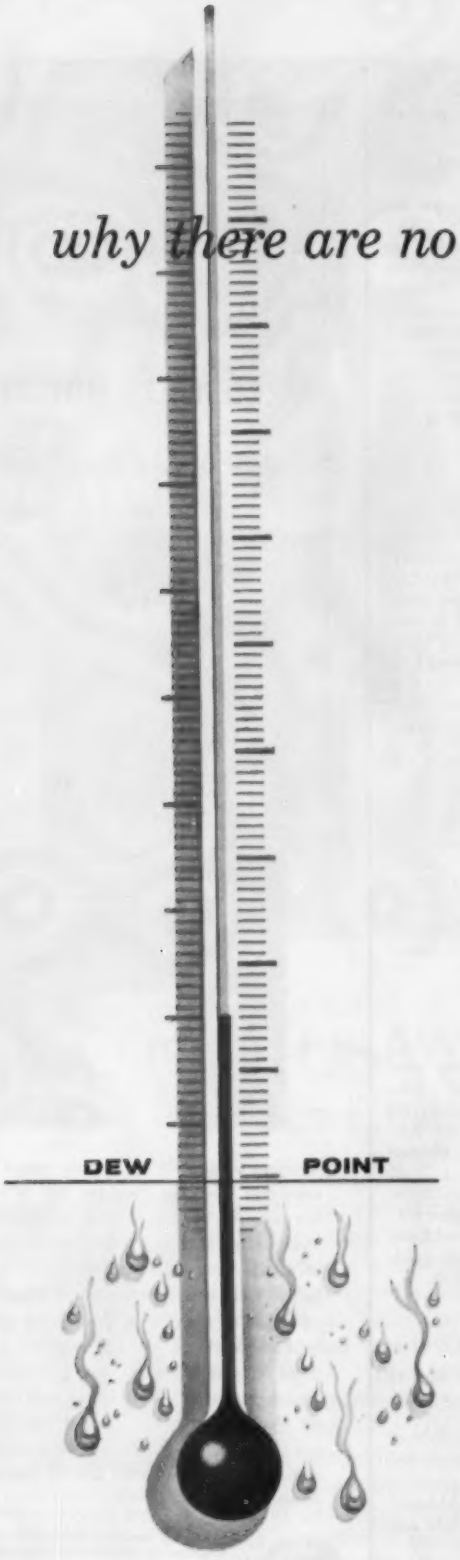
Felts Corp: W F Cox, Microdot div. **A P Green Fire Brick Co:** J W Swatek. **National Vulcanized Fibre Co:** Roy S Fisher. **Philadelphia Electric Co:** Milton I Allen. **Macwhyte Co:** F D Holden. **Durabla Manufacturing Co:** J G Buechel.

New representatives

For **Blaw-Knox Co,** power piping div: Plant Economy, Inc, 50 Broadway, New York 4, N. Y. For **Continental Foundry & Machine Co,** Copes-Vulcan div: Central Pump & Equipment Co, 3425 Olive St, St Louis 3, Mo. For **Cleaver-Brooks Co:** Ruffridge-Johnson Equipment, Inc, 3024 SE 4th St, Minneapolis, Minn; and Tamco Engineers, 204 Davis St, San Francisco, Calif.

For **Springfield Boiler Co:** C B Fuller, 80 Boylston St, Boston, Mass. For **J F Pritchard & Co:** Brownlee-Morrow Engineering Co, Birmingham, Ala., and Rittelmeyer & Co, Inc, Atlanta, Ga. For **Zallea Brothers:** Ben McKalip Co, 4176 E Admiral Pl, Tulsa, Okla. For **Robertshaw-Fulton Controls Co,** Fielden Instrument div: H J Klug Co, 2029 N 67th Ave, Omaha, Nebr., Electro Products, Inc, 940 N Alabama St, Indianapolis, Ind., and Broger Instrument Sales Co, Inc, 739 Boylston St, Boston, Mass. For **Conoflow Corp:** G S Edwards, 2856 S 18th St, Birmingham, Ala. For **Bulkley, Dunton Processes, Inc:** J L Middleton Co, Miami, Fla., and O'Brien Specialty Co, Syracuse, N. Y. For **Electric Regulator Corp:** H P Woodit & Associates, Jamaica, N. Y., The Satullo Co, Royal Oak, Mich., and Sheridan Associates, Cincinnati, Ohio.

(*Continued on page* 212)



why there are no cold spots and less corrosion in the Ljungstrom® Air Preheater

In the Ljungstrom, the heat-transfer surface rotates alternately through the gas and the air streams . . . keeping heating elements consistently hotter than other types in equivalent service. That's why there are no cold spots . . . and less corrosion in the Ljungstrom.

Even though corrosive action is slow, some does take place at the cold end of the Ljungstrom. This presents no problem, since the cold end is sectionalized to permit easy reversal and almost double life. Reversing or replacing the cold end does not disturb the rest of the elements and takes just a few hours.

Get all the details on the Ljungstrom Air Preheater. Send for the new, free, 38-page reference manual, "Ljungstrom Air Preheaters."

Advantages of the Ljungstrom Air Preheater

- **Size for size, recovers more heat than any other type.**
- **Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.**
- **Eliminates cold spots . . . keeps corrosion to a minimum.**
- **Easier, faster to clean and maintain.**
- **Requires far less supporting steel and is quickly erected.**

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

DO YOU HAVE A TWO-STAGE PRESSURE OR TEMPERATURE CONTROL PROBLEM

MERCOID® HAS THE SOLUTION

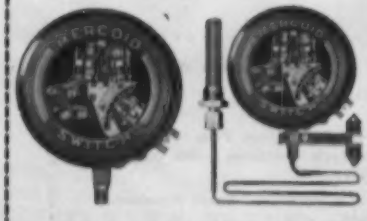
Mercoid DA-400 Series Controls are dual purpose controls (available for pressure or temperature) incorporating a single element operating two separate independently adjustable Mercoid magnetic mercury switches. Circuit arrangements can be supplied for various operations, a few examples are:

1. Close one alarm circuit at high setting and a separate circuit at low setting. Both circuits remain open between the high and low operating points of the two switches.

2. As an electrical interlock to open one circuit on a rise above, and the second circuit on a drop below the set operating point.

3. To provide two-stage control by opening one circuit on a rise and a second circuit on a further rise.

Pressure types available in 17 different operating ranges from 0-30" vac. to 300-2500 psi. *Temperature types* available in 11 operating ranges from -30-60°F. to 370-530°F.



All types are equipped with external adjustments and visible calibrated dial.

Our engineers are at your service—send in your control problem or

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4211 Belmont Ave., Chicago 41, Ill.

More APPOINTMENTS

Begins on page 206

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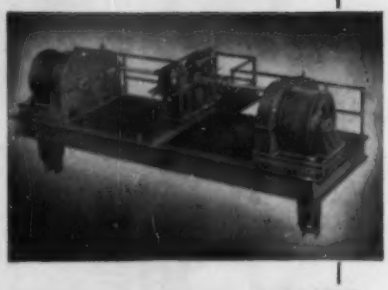
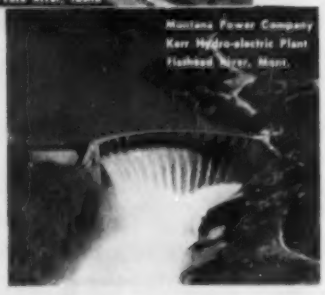


MURCO GATE HOISTS

for any Size Power Dam



Designed and built in a wide range of capacities from less than one ton to over one hundred tons . . . from the smallest hand operated to the largest motor operated gate hoist, MURCO Gate Hoists have behind them over seventy years of designing and building experience. During that time we have developed many designs and patterns. In planning gates and gate hoists, we suggest you write us before your overall plans are complete . . . it may save you time and money. We may have designs and patterns to fit your special requirements.

Write for complete information and Engineering Department recommendations to meet your specific power dam requirements.

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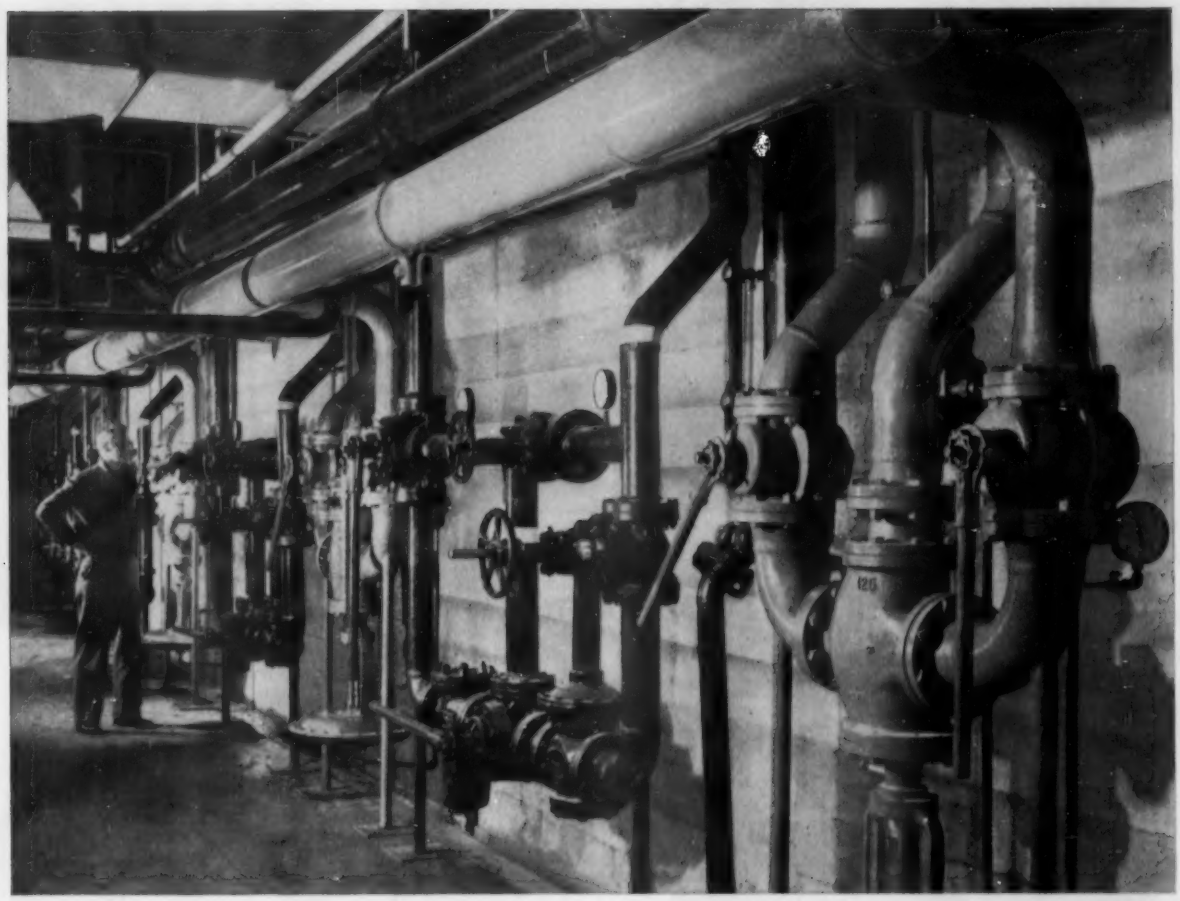

steel mill piping in sheet coolant and Morgoil system metering stations at Allenport Works

9½ miles of BLAW-KNOX piping serves Pittsburgh Steel's Allenport Plant

To get more information on piping for industry, send for your copy of Bulletin No. 2443.

One of the world's most extensive industrial piping systems . . . 50,000 feet of piping, ranging in sizes from ⅛ inch to 30 inches . . . is now in operation in the Pittsburgh Steel Company's plant at Allenport, Pennsylvania.

Fabricated and erected by the Blaw-Knox Power Piping Division, the system carries compressed air, oil, steam, gas, oxygen, hydraulic oils and water . . . at varying temperatures and pressures . . . to the 66-inch hot strip mill, the 66-inch 4-stand tandem cold-reducing mill and other equipment throughout the plant.

Work on the system was started more than two years before completion date. And each phase of the work had to be synchronized with the building program in order to have the mill go into production on time. Prime contractor on the mill was Ragnar Benson of Pittsburgh.

This kind of service is readily available to you through our Power Piping Division. Just tell us your requirements and we'll provide the service you need.

BLAW-KNOX COMPANY
POWER PIPING AND SPRINKLER DIVISION
PITTSBURGH 33, PENNSYLVANIA

BLAW-KNOX

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Complete prefabricated piping systems for all pressures and temperatures . . . plus complete line of functional spring hangers • constant support spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators

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Mercoid DA-400 Series Controls are dual purpose controls (available for pressure or temperature) incorporating a single element operating two separate independently adjustable Mercoid magnetic mercury switches. Circuit arrangements can be supplied for various operations, a few examples are:

1. Close one alarm circuit at high setting and a separate circuit at low setting. Both circuits remain open between the high and low operating points of the two switches.

2. As an electrical interlock to open one circuit on a rise above, and the second circuit on a drop below the set operating point.

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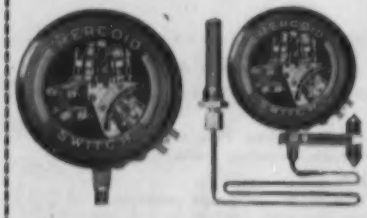

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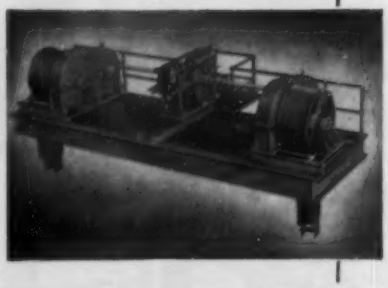

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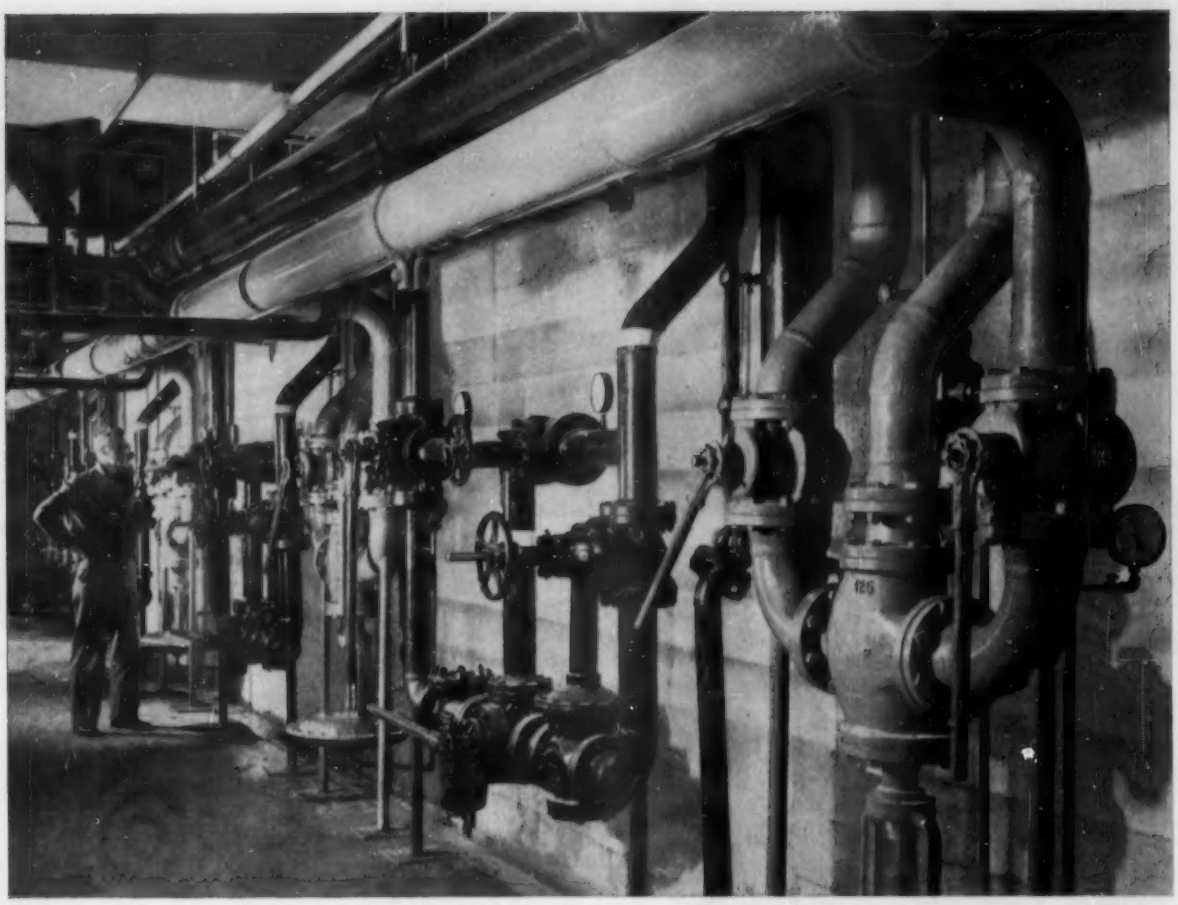

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Complete prefabricated piping systems for all pressures and temperatures . . . plus complete line of functional spring hangers • constant support spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators

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liquid caustics

Whether it be for Sodium, Potassium, Calcium, Ammonium, Barium or Magnesium Hydroxides, or in fact any strong alkali, White-Lon, Chesterton Style No. 322 will make a tight, trouble-free, lasting and alkali-proof *packing seal.*

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White-Lon is ideal for stainless steel and chrome plated shafts. It is white in color, contains no graphite but has received a light breaking-in lubrication.

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A pH SCALE FOR CHEMICAL PACKINGS

1 ..... TO 4	5 ..... TO 10	11 ..... TO 14
pH VALUES	pH VALUES	pH VALUES
STRONG ACIDS	WEAK ACIDS OR ALKALIES	STRONG ALKALIES
#320	#315	#322
Blu-Lon	**Carsons**	**White-Lon**

PACKING Chesterton SERVICE

A. W. CHESTERTON CO. • EVERETT 49, MASS.
America's Oldest Manufacturer of Mechanical Packings

MARMADUKE

Continued from page 150

pairs in that heavy sea without being capsized from a broadside while our engine was dead. Pulling apart an 18-ft-high vertical engine in bad weather is mighty dangerous.

"We removed the cracked cylinder cover and the connecting rod while bobbing around like a cork. Trick was to snub those heavy pieces while raising them with chain falls to keep them from smashing us and our machinery. First we raised the 22-in. diameter hp piston enough to remove her rings, then we dropped her to the cylinder's bottom. Next, we removed the hp valve, stem and connecting rod, along with the eccentric strap. We plugged the valve-stem opening in the valve cylinder by bolting two gasketed flanges over each end of her stuffing box with a through stay. Then we bolted down her cylinder cover.

"Next, we plastered litharge over the crack of the hp cylinder head to keep her from leaking steam. A piece of floor plate, bolted over the cracked head against a blank gasket, helped reinforce her. Then steam could pass to the intermediate-pressure cylinder through the hp valve chest and cylinder as though they were large pockets in the main steam line.

"We reduced the boiler pressure from 200 to 90 psi, which was the i-p cylinder pressure—and we proceeded compound.

"By the time we limped into Portsmouth, Maine, five days late, we had a sad-looking ship with a beat-up crew. We were dog tired and numb from overwork and no sleep. But we got there, and ship and cargo were safe. Now we could take it easy until we were ready to shove off—at least that's what we thought.

"But the old man told me he'd have to turn around in three days and asked to have the engine running on all cylinders by that time. In those days the ship's engineers did their own work. I told him our departure depended on how long it would take the local foundry to cast and machine a new cylinder head.

"The thermometer nose-dived that morning, and by the time I got over to the Eastern Gray Iron Foundry & Machine Co across the tracks, the temperature was around 30 below. I told the foundry boss my problem and suggested he use our broken cylinder head as a pattern, after he fixed it up for shrinkage.

" 'Can't help,' he said, standing near the pot-bellied stove to keep himself warm. 'We wrecked our steam engine this morning. The shaft snapped as we started her—the drain cock was open so

CARRYOVER

spoiled 50,000 yards of cloth

A costly problem faced the Drew field engineer, when he called on a major Eastern textile mill. This serious situation was solved effectively and at low cost.

The Drew man, an experienced industrial water expert, thoroughly surveyed the boiler plant and operating conditions. He collected a complete set of pertinent water samples, which were studied in the modern Drew laboratories. All data was correlated, and antifoam—ORGANIC "U-14-L", decided upon, along with other treating chemicals. In less than 24 hours after Drew treatment was started, foaming—the cause of carry-over, was ended; the staggering costs of spoiled cloth and lost man hours, eliminated!

Why not invite your Drew area engineer to discuss your industrial water problems? Meanwhile, write for a copy of "Complete Boiler Water Conditioning"—it's free.

Power Chemicals Division

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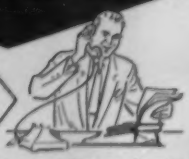
Service throughout the United States, Canada and South America

4 EASY STEPS TO BETTER PRODUCTION HEAT



1 Call in

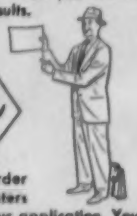
the experienced Chromalox Electric Heating Specialist serving your area. He's as near as your phone.

2 Talk over

your heating plans and problems. You'll be given "case histories" of successful applications similar to your own.

3 Work out

the details of your application with the Chromalox Heating Specialist. Tell him what you want to accomplish in the way of results.



4 Follow Through

on the recommendations. Order the Chromalox Electric Heaters and controls needed for your application. You'll be more than pleased with the time, money and material saving results you'll get with Chromalox Electric Heat!

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A STAFF OF EXPERIENCED APPLICATION ENGINEERS

SEND FOR "101 WAYS" HANDBOOK and address of Chromalox Engineer serving you.

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CHROMALOX
ELECTRIC HEAT
FOR MODERN INDUSTRY

MARMADUKE

Continued from page 214

there must have been a chunk of ice in the cylinder.'

"He pointed out the window to a large open shed. I could see his millwrights pressing the broken crank out of the large horizontal one lunger's flywheel.

" 'That engine's been a jinx,' he complained. 'She's had a cracked shaft for over a month. We clamped the webs together with a strap-iron bracket to keep her going, while waiting for a new crankshaft. All we have to do on the new shaft now is turn her down to a press fit where it presses into the flywheel.'

"I walked out into the open shed for a look-see. The engine was direct-connected to an electric generator. Millwrights told me her current was used for running the foundry's large crane, cupola's blowers and for lighting. The machine shop used ac from the power company. I saw the engine had a 6-in.-diameter shaft. Then I went back inside and told the boss that by the time I got a truck, loaded my cracked cylinder head and brought it over, he should have the steam engine running.

"Two hours later I was back with the head. The millwrights had just placed the new crankshaft between centers in the large engine lathe. The machinist went out into the open shed and miked the flywheel's bore with inside mikes. It measured 5.9975 inches. He hurried back into the warm shop and added 0.0015 in. to the inside dimension for the press fit he was going to turn the shaft to.

"Things looked hopeful, so the boss sent out for a can of red-hot coffee. About the time we got through ballasting, the machinist had turned the shaft down. He miked it and said it was perfect. I started back for the ship, but asked the boss how long before he'd have my cylinder head.

" 'Suppose we go into the pattern shop and see how it's coming,' he answered. 'If I can have that steam engine by noon,' he continued, 'we'll have your casting by quitting time. Then we'll put your head on the boring mill tomorrow morning, machine the joint face, drill the stud holes and have her aboard by sailing-day morning.'

" 'That suits me fine,' I answered, 'because my boys aboard ship will have our engine ready to close up soon as we get that head.'

"Just then the machinist came into the pattern shop cursing a blue streak.

" 'Boss,' he wailed, 'I can't understand it. I turned the shaft according to my measurements and added the right amount for the shrink fit, but the millwrights slipped the shaft right into

☑ *what* do you want to see?

☐ **WATER LEVEL?**

Pressures to 100 p.s.i.—CORNING brand STANDARD gauge glasses. To 300 p.s.i., and high temperatures—PYREX brand HIGH-PRESSURE gauge glasses. To 300 p.s.i., and corrosive conditions—PYREX brand HEAVY-WALL gauge glasses. For greater visibility—PYREX brand RED-LINE gauge glasses. 350 to 5000 p.s.i. (and higher in some cases)—MACBETH brand FLAT gauge glasses.

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PYREX brand SIGHT GLASSES give you typical advantages of PYREX brand glass No. 7740—high thermal shock resistance, chemical stability, physical stamina, clear visibility, resistance to clouding.

☐ **LUBRICATION LEVELS, OIL LEVELS?**

PYREX brand lubrication and oil-cup glasses—long-lasting, chip-resistant, easy to install. Accurate dimensions insure a snug fit.

Your Industrial Distributor has a complete line of Corning quality gauge glasses—let him help you select the types which will best serve your needs. Call him today.

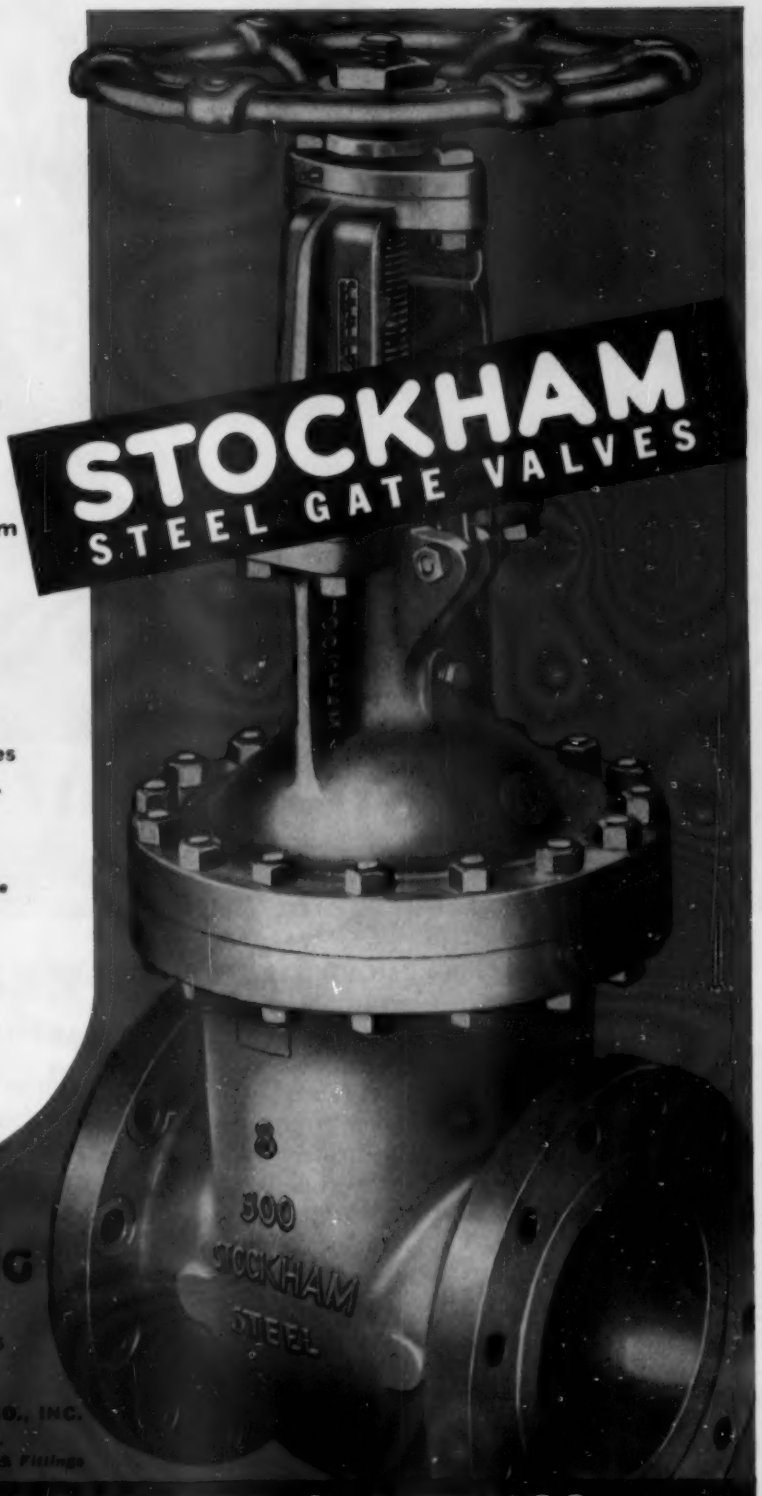
CORNING INDUSTRIAL GLASSWARE FOR EVERY JOB

Application	*Recommended Product*
Normal Conditions (Up to 100 p.s.i.)	CORNING brand standard gauge glasses
Higher temperatures	PYREX brand high-pressure gauge glasses
Higher pressures	PYREX brand heavy-wall gauge glasses
Extra visibility	PYREX brand red-line gauge glasses
Viewing inside furnaces, reactors pressure vessels, etc.	PYREX brand sight glasses
Lubrication inspection	PYREX brand lubricator glasses
Visible discharge devices	PYREX brand oil cup glasses

CORNING GLASS WORKS
Corning, New York

Corning means research in Glass

Meet severe operating conditions...



These steel valves provide maximum flow with minimum friction and pressure loss in full open-close operation. Rugged I-Beam design discs. Stainless Steel stem with 11½-13 chromium content. The wide variety of trim combinations meet all service conditions. All sizes have seven drain or by-pass bosses. Available in sizes 2" through 12", rated 150 and 300 pounds.

Write for Stockham's clear, concise and complete Steel Valve Catalog and find out more about these rugged dependable valves.

VALVES: Bronze • Steel • Iron Body

FITTINGS: Cast Iron Screwed, Flanged
Cast Iron Drainage
Malleable Fittings & Unions

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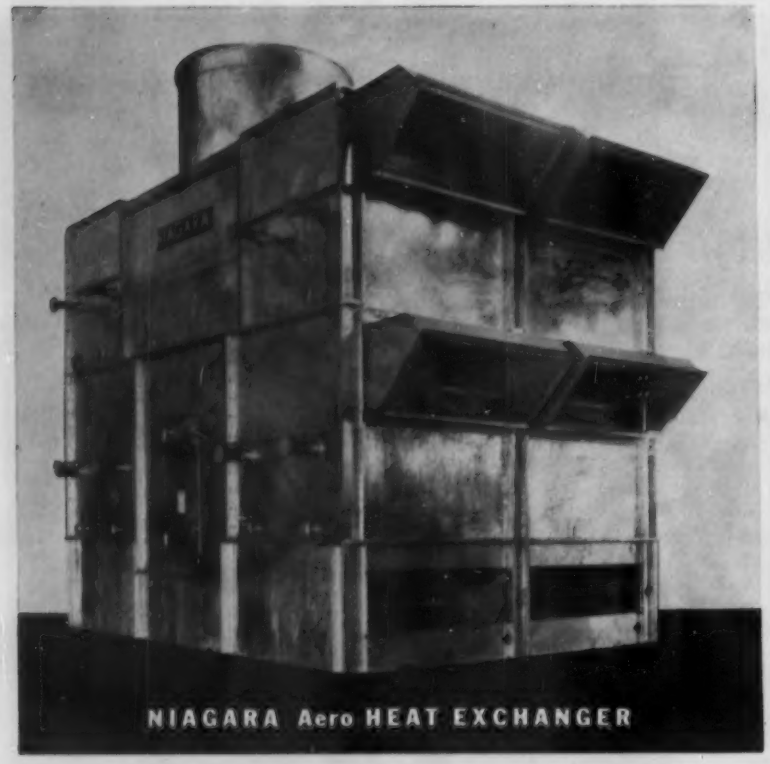

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You can cool and hold accurately the temperature of all fluids, air and gases, water, oils, solutions, chemical intermediates, coolants for mechanical, electrical and thermal processes. You obtain closed system cooling free from dirt. You solve all the problems of water availability, quality or temperature.

In CHEMICAL PROCESSES this is successfully used in cooling liquids and gases, chemical reactions, condensing distillations and reflux cooling.

Write for complete information; ask for Bulletins 120 and 124. Address Dept. P.

NIAGARA BLOWER COMPANY

405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities of United States and Canada

MARMADUKE

Continued from page 216

the flywheel. We've got it back in the lathe again, but I don't know what to do.'

"'What!' yelled the boss, growing pink around the gills and starting to blow a gasket. 'Now how the hell did that happen?'" But I stopped him short.

"'Wait a minute,' I said. 'I know what happened. That flywheel was about 25 degrees below zero when he measured it. But his inside mike was about 50 degrees. So the temperature difference made the hole smaller than it really was. When the flywheel hub warmed up inside the shop, it was probably loose by about 0.002 in. The machinist here was in such a hurry to do the job that he forgot to leave his inside mikes outside long enough to cool down to the flywheel temperature.'

"We went into the machine shop. The boss checked it with outside mikes and started blowing his stack again.

"'Now we'll have to weld a layer of metal over the shaft, anneal it and then heat-treat the shaft and turn it down to size again,' he raved, walking back, popping his safeties.

"I asked the boss to calm down and get me a half-dozen prick punches and ball-peen hammers. When he got them, I told the millwrights to get busy and prick-punch the shaft's end. They got the idea. In a little while, the undersize shaft was covered with thousands of prick-punch marks. The tiny raised-ring areas increased the shaft diameter enough so when they placed the shaft in the press, it took over two tons to drive her home. When they drove in the key the job was ready to assemble. In a short while the engine was cranking away and the foundry crane and blower were in operation."

Marmy hoisted a cup of black coffee down his hatch and roared. "Three days later we shoved off on schedule. Those were the days when a marine engineer was an engineer. I not only had a job getting that ship into port, but it also took a little headwork to get those landlubbers straightened out so we could get back to sea again."—*SME*

Marmy's Mailbox

No less than eight of our engineers read POWER. When I take my copy to the plant, we all enjoy Marmaduke Surfaceblow first thing. We think he's wonderful. You editors are doing a grand job on POWER and your articles are a real help to plant operators like us.

J J BURNS *Sudbury, Ontario*

6 STAR FEATURES

years ahead!

A VERTICAL SPLIT CASE PUMP

B & G SERIES 1510

TYPE B CENTRIFUGAL PUMP

. . . with balanced loading of impeller and bearings . . . handles loads far in excess of those produced by any pump and motor combination! Easily serviced without breaking pipe connections!

1. **Leak-proof Mechanical Seal.** Features the exclusive, harder-than-glass B & G "Remite" insert. This Seal construction has enabled nearly two million B & G Pumps to make an amazing record for failure-proof performance.

2. **Hydraulically Balanced Impeller.** Balancing chamber and pressure relief holes in the impeller reduce thrust to a minimum, lengthening pump life.

3. **Solid-type Volute with Support Foot.** Can be left in pipe line when servicing pump —rugged construction absorbs piping strains.

4. **Removable Bearing Frame.** Complete bearing frame, including seal and impeller, can be removed without disturbing piping or motor leads. The bearing frame is replaceable and interchangeable on all sizes.

5. **Anti-Friction Roller Bearings.** Timken Bearings handle thrust and radial loads for smoother, quieter, more efficient operation.

6. **Oil Lubrication.** No messy, undependable grease cups—circulating oil lubrication assures positive protection to bearings. Oil level indicator permits visual check.

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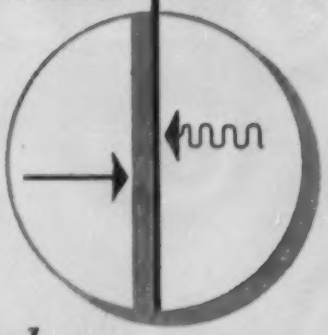
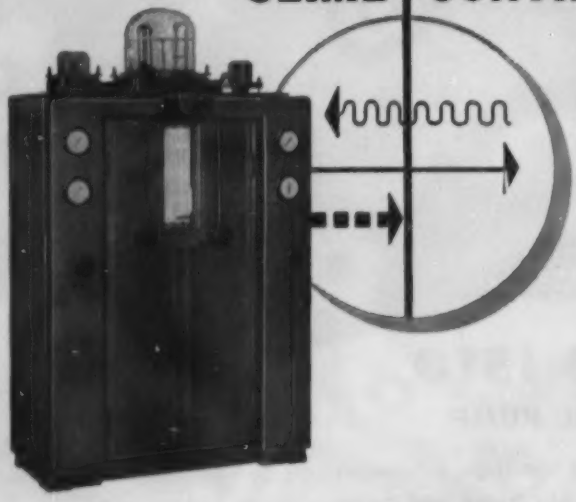


Be sure you have

SLIME | CONTROL



Whether you heat or cool water for make-up, process or any other use, you will need Wallace & Tiernan Chlorination to help combat slime problems introduced by water-borne bacteria or air-borne bacteria.

With slime control equipment designed for any need, built for lasting and dependable service, highly accurate and backed by over 40 years of successful application experience, Wallace & Tiernan Chlorination can help you increase the efficiency of your plant and cut operating costs. For further information write our Industrial Division.

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CD-39

AIR-VELOCITY CONTROL

Continued from page 87

about 130%. Reason: Static-pressure control doesn't take into account duct-friction decrease, an item that drops off by the square of velocity changes.

For third test run we used a differential-pressure regulator to hold velocity-pressure through sample damper constant. Note that supply-fan static discharge pressure fell from 0.57 to 0.32 in.

We still had to find out whether velocity control at sample damper holds velocity at other outlet dampers approximately constant. So, with sample damper under full-automatic velocity control, we took velocity-pressure readings at other dampers supplying conditioned areas. Test No. 4 data show results. Differences don't necessarily indicate control errors since initial velocity-pressure settings were varied slightly to take care of different conditioned-space needs.

Trial run was held without telling the operating engineer or tenants. Some weeks later the engineer wanted to know what happened. "The worst system in the building for noise and drafts—then, suddenly, no more complaints!" When we let him in on the secret, he quickly got authorization to install velocity control on all air-conditioning systems in the building.

Sampling duct, Fig. 6, can be used where it isn't practical to control velocities at a sample damper because: (1) Sample damper should be locked in a fixed position. If there aren't enough dampers in a conditioned space, taking one damper off thermostatic control will affect space conditions. (2) Straight run of duct must lead to sample damper —a condition that's often tough to meet.

Although velocity control on supply-air fan solved noise and draft problems, it trimmed outside air to the system below desirable levels, largely because control system can reduce supply-fan capacity without cutting back on return-air-fan capacity. In some cases return air actually *passed out* of the minimum fresh-air duct, reducing minimum fresh air to zero.

Solutions proved to be (1) velocity-pressure control on the minimum-outside-air intake or (2) differential-pressure control across a damper or heating coil. Signal from (1) or (2) operates inlet vane on return-air fan, Fig. 7. If velocity in the minimum-outside-air duct drops below control point, return-air flow reduces enough to allow correct fresh-air flow.

Test results also showed that, with volume dampers in conditioned spaces open, inlet vane on return-air fan was open. With volume dampers in a minimum closed position, inlet vane closed

LOWEST COST PER POUND OF STEAM

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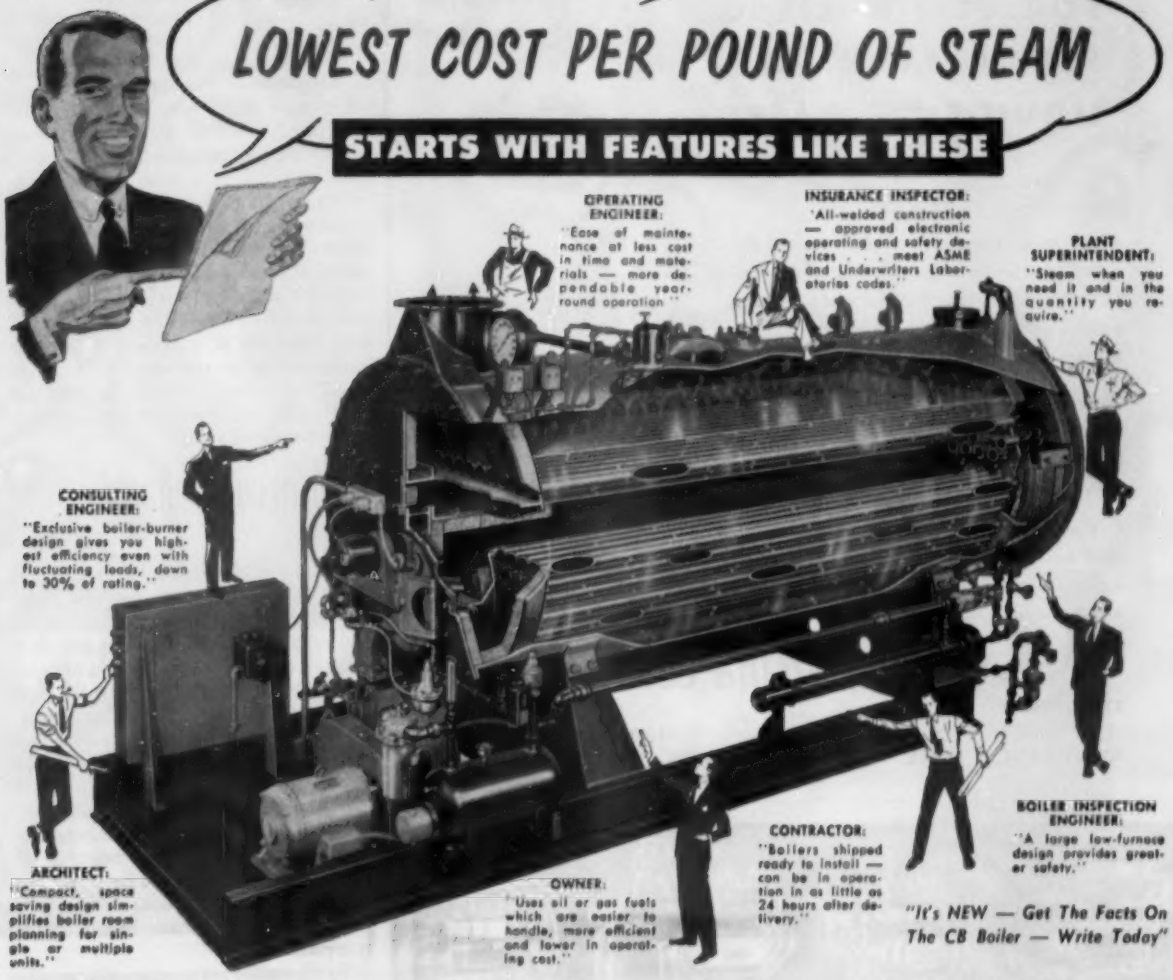
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"Exclusive boiler-burner design gives you highest efficiency even with fluctuating loads, down to 30% of rating."
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"Compact, space saving design simplifies boiler room planning for single or multiple units."
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YOU BENEFIT from more than 20 years of experience, working closely with men who have made it their business to be *right* about boilers. You profit from complete coordination throughout planning, installing, supervising and final operation.

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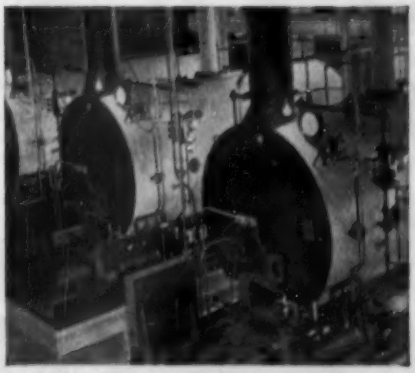
Whether you're planning a new steam plant or modernizing, make certain you get the complete Cleaver-Brooks story before you buy. See your Cleaver-Brooks representative, or write for catalog AD-100. Cleaver-Brooks Company, Dept. D, 301 East Keefe Avenue, Milwaukee 12, Wisconsin, U.S.A. *Cable Address CLEBRO — Milwaukee — All Codes.*



One typical owner can count on yearly savings ($15,000 fuel and $10,000 labor) from this battery of three 150 hp Cleaver-Brooks self-contained boilers.

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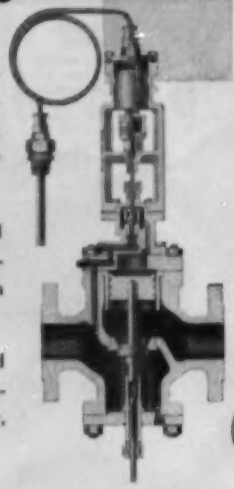
FOR CONTROLLING TEMPERATURE OF LIQUIDS OR GASES

TEMPERATURE REGULATORS

FOSTER TYPE T



Foster manufactures a complete line of temperature regulators for all types of service — for hot water storage heaters, fuel oil heaters, pasteurizers, ovens, driers, cookers and other process heating and cooling equipment.

They are available in single or double-seated construction; direct or reverse acting; in combination with pressure reducing valves; and in proper materials for the type of service.

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Large 2-Cyl. Ammonia Compressors
Large 4-Cylinder Compressors

AIR-VELOCITY CONTROL

Continued from page 220

70%, to maintain minimum fresh air.

Conclusions. (1) Automatic control of velocity is best way to vary supply-fan characteristics. (2) Velocity control is a must, to get right air distribution with minimum noise and drafts in varying-volume systems. (3) Where flow resistances vary over a wide range, velocity control will hold delivered-air volume constant. (4) When return-air fans are used, apply velocity control in outside-air duct. (5) If a return-air fan isn't used, *and* if return-air-duct-system resistance is greater than in fresh-air duct, use velocity control in fresh-air duct. This will keep outside air below a set maximum value.

FEED REGULATORS

Continued from page 119

Sometimes a multiple effect evaporator is used. Vapor from the first stage is condensed in the second-stage coils, and vapor from the second (or the last) stage is condensed by a stream of relatively low-temperature water. If the last-stage vapor is below atmospheric pressure, unit may need a steam-jet air ejector to remove noncondensable gas accumulations.

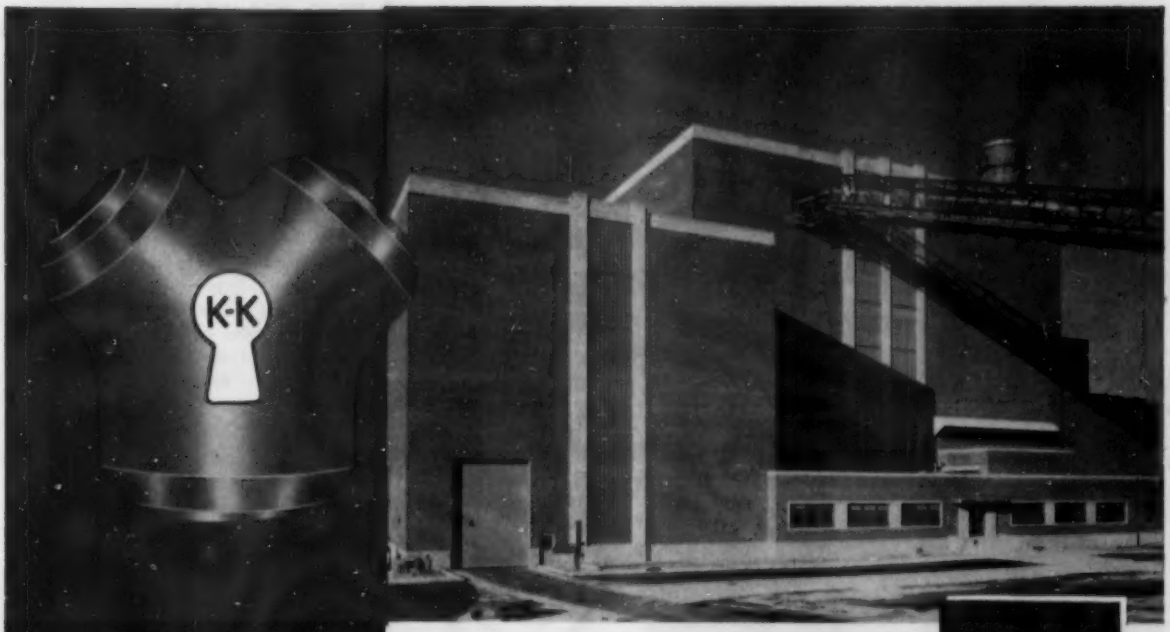
Usually, where the shell is under pressure, initial venting as the pressure is raised removes the large quantities of air initially present. Afterwards, air not removed by the evaporator deaerator is carried on to the main deaerator for removal.

Steam for the evaporator coils usually comes from a bleed point on the main turbine, but it may come from the boiler drum or some other source at sufficiently high pressure. Coil should be continuously vented to prevent air-binding and consequent capacity loss. The vent may be run to the evaporator deaerating heater, thus using heat in the steam removed. Pressure in the coil usually forces the condensed steam back through a drainer control valve into the boiler feed system.

After the evaporator, preheater and auxiliaries are installed, leveled and piped up, check the following points. Have all packing and crating been removed? Are trays and pipes and accessories of the deaerating heater in place and level? Are evaporator shell gage and control set so water level is an inch or two over the coil? Are safety valves free and in operating condition?

If possible, apply a hydrostatic test to the evaporator and connecting piping before startup. This saves later delays because of leaks when the station is being started up.

You can often operate the evaporator



KEY-KAST "Y" FITTINGS

serve main steam, hot reheat lines of new power plant

Insistence on unfailing strength and complete dependability was a major factor in Potomac Electric Power Company's selection of Key-Kast Alloy Welding "Y" Fittings for the main steam and hot reheat lines of its Potomac River Plant, Alexandria, Virginia.

These rugged Key-Kast fittings offer greater strength and longer life for power systems for these reasons:

- Increased structural strength, with greater wall thickness throughout
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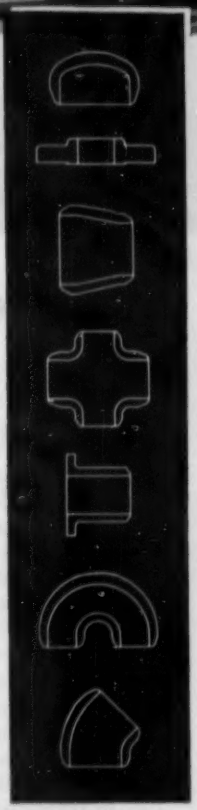
- Produced by most economical method
- Available in all shapes, sizes, schedules... in low and intermediate alloys and various stainless steels
- Meet A.S.M.E., A.S.T.M., A.S.A. Codes
- Controlled quality, through rigid metallurgical control



Whatever your alloy piping need, you'll find a Key-Kast fitting to fill it.

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Tired of getting "the treatment" from water treatment pumps?
Here are 4 points for trouble-free proportioning
COMPLETELY ENCLOSED
ADJUSTABLE WHILE IN OPERATION
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BUILT-IN PRESSURE RELIEF
"K-3" pump handling phosphate and sodium sulphite.

HILLS-McCANNA "K" Type Hydraulic Drive Pump

In the Hills-McCanna "K" Type proportioning pump, working parts operate in a bath of lubricating oil which also serves as hydraulic fluid. This unique in-line, direct acting hydraulic drive system is the result of long experience in the solution of problems peculiar to boiler feed water treatment applications. Ordinary pump maintenance and service problems involving vertical type liquid ends, exposed linkage and linkage lubrication . . . linkage and drive misalignment are eliminated.

Hills-McCanna "K" Type pumps are available in one and two feed units in capacities up to 726 gph per feed. "Packaged units," suitable for phosphate or sulphite treatment, are also available.

Write for Bulletin KP-54. HILLS-McCANNA CO., 2369 W. Nelson St., Chicago 18, Ill.

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metering and proportioning pumps

Also Manufacturers of:
SAUNDERS TYPE DIAPHRAGM VALVES
FORCE FEED LUBRICATORS • MAGNESIUM SAND ALLOY CASTINGS

FEED REGULATORS

Continued from page 222

from another steam source and recirculate or otherwise cool condensate or water used to condense vapor. This produces a supply of distilled water for initially filling the new boiler.

Best-quality distillate is produced when the evaporator operates at low rating with steady normal water level and reasonably low solids concentration in the shell water. If coil pressure is suddenly raised or shell pressure suddenly lowered, the rapid boiling resulting may cause temporary carryover.

More PLANT PROBLEMS

Begins on page 138

Tube temperature (from p 139)

Materials, insulators are recommended

COUPLES MADE OF 14 or 20 B&S gage wire are suitable for superheater installations. Usually the 14 gage is used because its larger size improves service life.

For boiler-tube temperatures below 500 F, copper-constantan is the most satisfactory couple. Iron-constantan is economical up to 1400 F and is especially good where there is a deficiency of oxygen, as in flue gas.

Asbestos insulation is OK up to 800 F. Above this figure, use porcelain insulators. If wires are not protected they combine with sulfur in gases, not only causing them to deteriorate, but also altering the temperature-voltage relationship as well.

W WILLS, JR. *New York, N. Y.*

These readers sent good answers, on measuring tube temperatures, for which we lacked space:

W M HUFF	*Chamois, Mo.*
E J ANDERSON	*Cleveland, Ohio*
C G HOWARTER	*Canton, Ill.*
D R BETTS	*Middleport, Ohio*
A BELTON	*Montreal, Can.*

Motor-insulation (from p 142)

Use class H when others give you trouble

IF PRESENT INSULATION is doing the job, why increase costs 60%? I recommend using regular insulation unless motors are overloading or burning out. If this is the case, check with motor manufacturer before going ahead with higher-cost motor insulations.

C G HOWARTER *Canton, Ill.*

(*Continued on page 226*)

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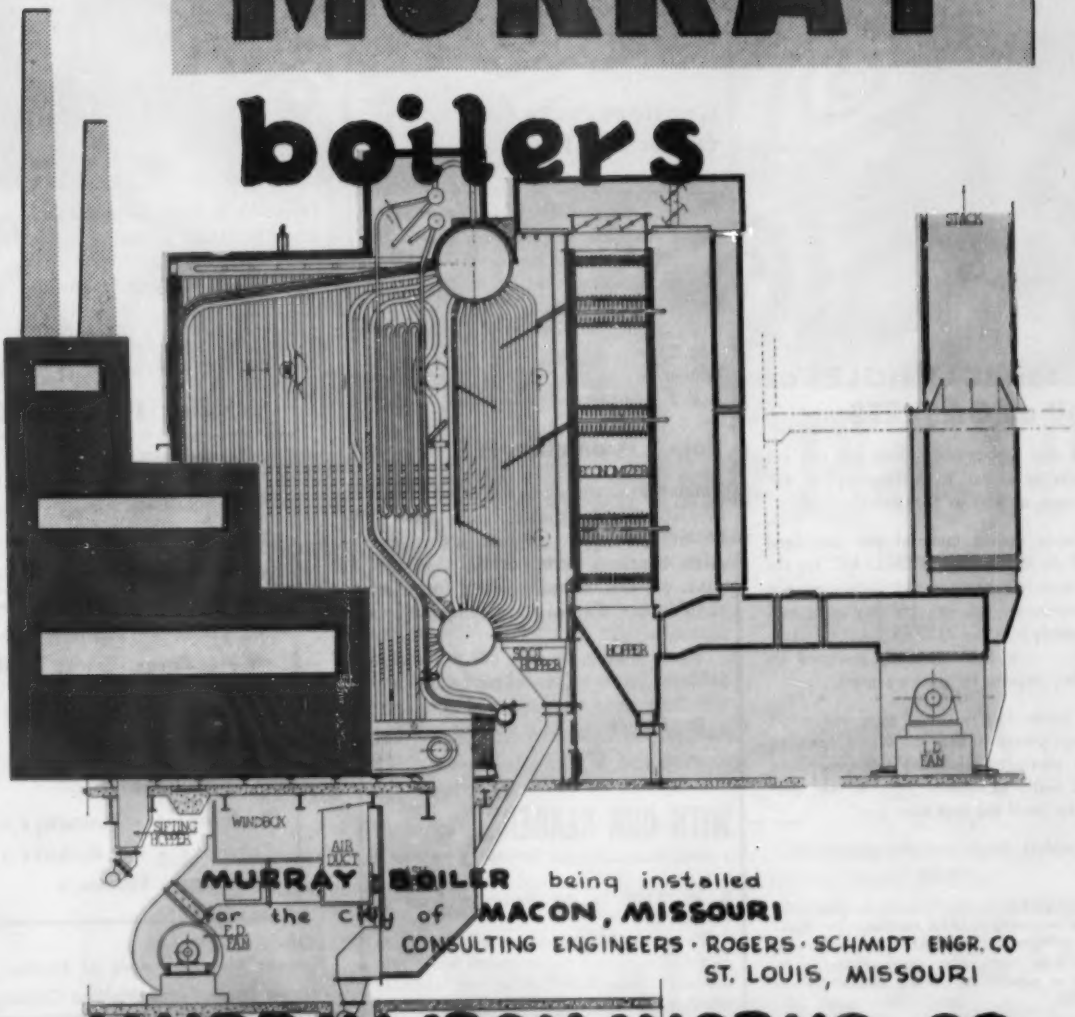
KNOWN for QUALITY

MURRAY

boilers



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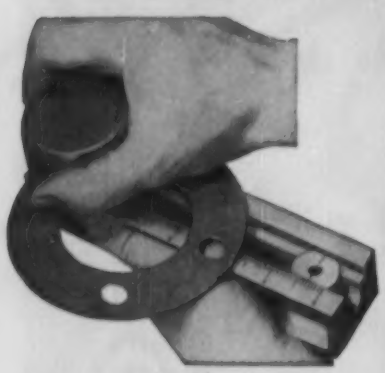
...are tools that pay for themselves the first time used



...for BOLT HOLES as well as GASKETS

With this tool in your plant you can cut gaskets up to ¾" thick, from ¼" to 48" diameter, as well as bolt holes.

Whatever gasket material you use, (and you'll do well to choose "ALLPAX" for the maximum in protection and the minimum in maintenance), you can cut it quickly and accurately with the ALLPAX GASKET CUTTER . . . a tool especially designed by packing experts for packing users.

This handy tool is saving time and effort in large plants all over the World, enabling these plants to meet any emergency and avoid costly shutdowns . . . *a tool that pays for itself the first time used.*

Complete details available promptly on request.

Contact ALLPAX or your nearest distributor for details concerning ALLPAX Packing, "The Packing that Packs All". ALLPAX also offers special packings to order, valve discs, retainer rings, molded or mandrel cut packing rings and packing hooks.

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Superheat Sheet Packing . . . Oil Proof Sheet Packing . . . Red Rubber Sheet Packing . . . Diaphragm Sheet Packing . . . Cloth Inserted Sheet Packing.

More PLANT PROBLEMS

Begins on page 138

Motors must match load

A CAREFUL SURVEY of his plant may show *JS* that some of his motors are not matched to their loads—especially those that consistently burn out. Also, he should correct bad atmospheric conditions.

Moisture, acid, vapor, abrasive dust and other factors may cause insulation to break down. Insulations that give good service in one location may be a poor choice for another. For this reason, use of one insulation class throughout the plant is not recommended, unless conditions are uniform.

J F MAHER *Kirtland, N. M.*

Consider these four factors first

PAST RECORDS tell a great deal about motors. If rewinding is needed too often, insulation isn't necessarily the reason. *JS* should find out if (1) motors are running in a dirty or oily atmosphere (2) whether there is lack of ventilation (3) motors are overloaded and (4) there are electrical faults in the system.

E J ANDERSON *Cleveland, Ohio*

Pointers on class H

BEFORE REWINDING with class-H motor insulation find out if air gaps have to be larger to allow for rotor expansion. Also, bearings must permit additional shaft expansion and bearing lubricant should be stable at high temperatures encountered.

When baking, be sure not to damage soldered joints or anneal copper in commutators.

W M HUFF *Chamois, Mo.*

WITH OUR READERS

Continued from page 5

K M White in the December issue of POWER.

We would like to use a set of tests to establish minimum requirements in our promotional procedure. Also, to indicate whether we should alter our present training.

Joliet, Ill. L G MARKWELL
Power Engineer, U. S. Rubber Co.

EDITOR'S NOTE: *This is but one of a flock of inquiries following White's article. From where we sit it appears that careful testing and selection of power-plant operators is a problem and White's methods are one good answer, giving a quick and fairly accurate indication of a man's capabilities.*

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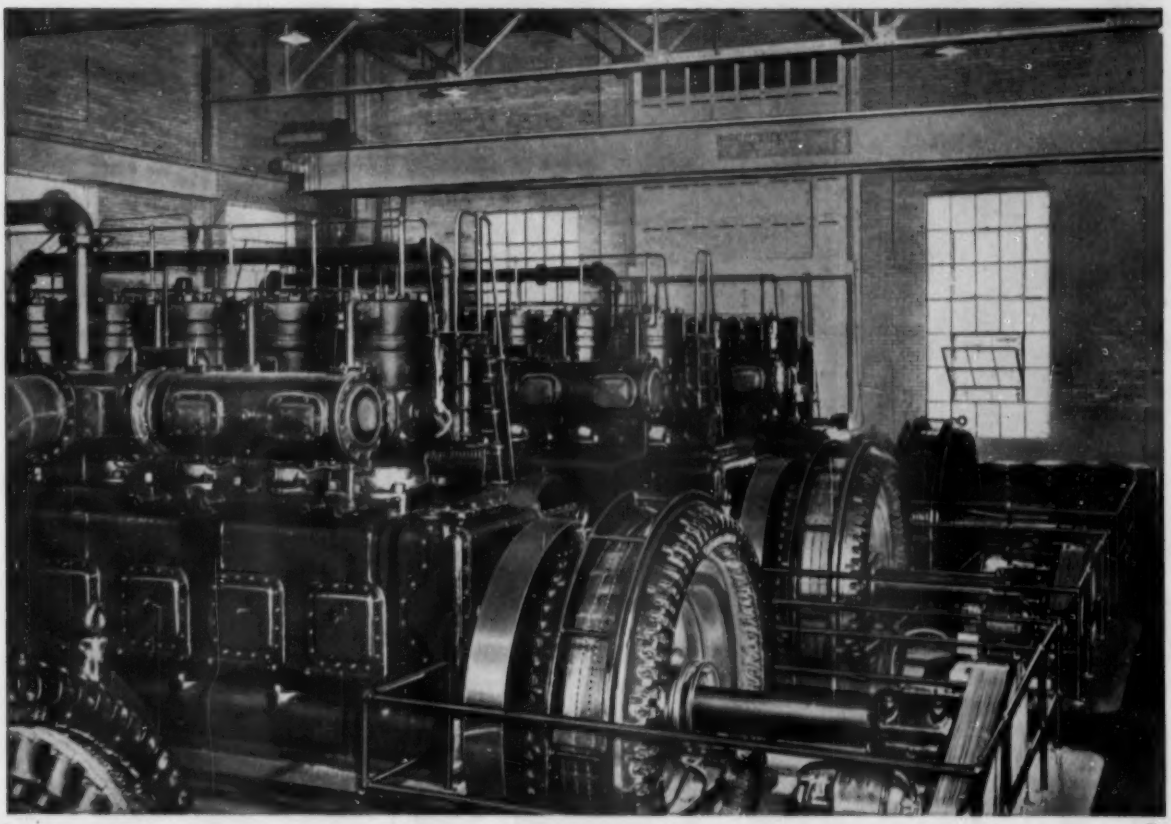


"We're Proud of This Plant!"

says Don H. Decker, — Plant Supt., Thumb Electric Cooperative, Ubly, Mich.

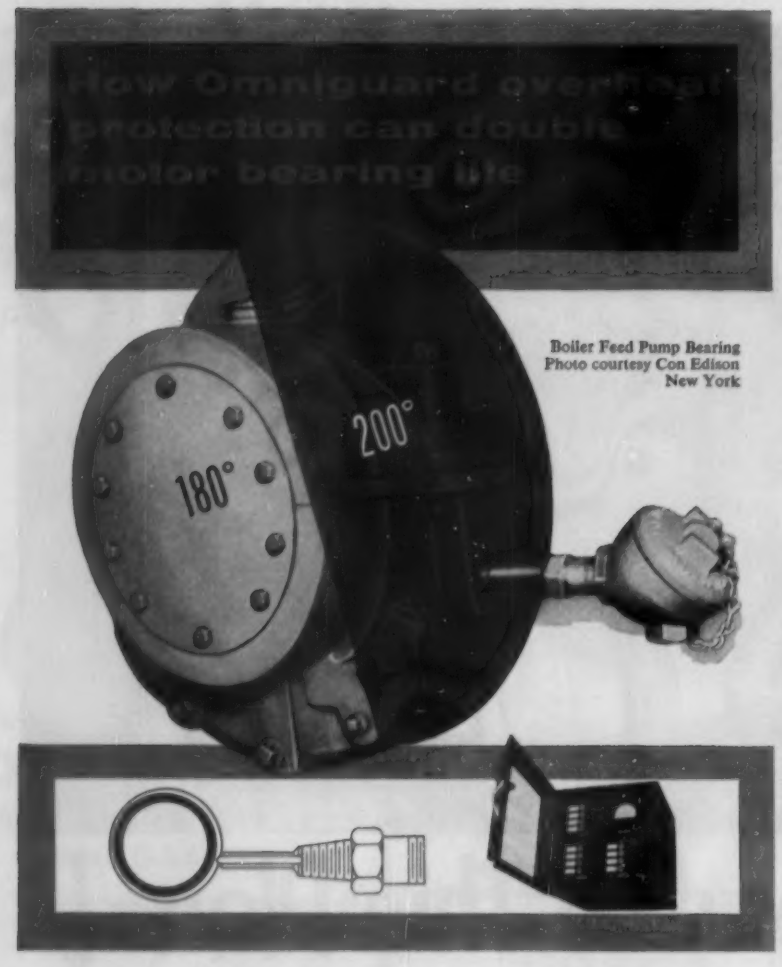
Manager Orville Hurford and Mr. Decker are justifiably proud of their 4-diesel engine generating station. The plant has been an outstanding financial success since the day it was first opened. Several times it has occupied #1 position on the REA Running Plant capacity chart.

Mr. Decker writes, "A large part of our operating success we attribute to Sinclair GASCON® D oil. It has given us an excellent rate of consumption while reducing wear. In fact, *cylinder and piston ring wear is much below normal based on other plants of equal capacity*. Something else we appreciate is the timely visits of the Sinclair Lubrication Engineers."

Top quality lubricants plus the assistance of Sinclair Lubrication Engineers are two of the reasons why Sinclair can play a large part in the success of *your* operation. Your local Sinclair Representative will be happy to explain the remaining reasons. Phone him or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save Wear and Replacement



Boiler Feed Pump Bearing
Photo courtesy Con Edison
New York

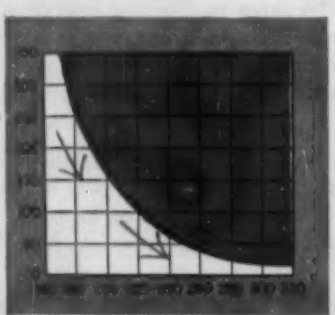
Any way you look at it, Omniguard becomes a necessity for today's high-speed automatic plant equipment. Omniguard signals *instantly* when an overheat condition is near—*before* valuable equipment or processes are harmed.

Recent studies* prove, for example, that a mere 20° increase above 180°F. cuts in *half* the bearing life of rotating equipment. And this is just one instance of the devastating effects of overheat that EDISON Omniguard prevents.

Omniguard focal point is a panel easily understood at first glance—without complex gadgets—linked directly to possible trouble spots by resistance temperature detectors. Remote control indication is available too.

Omniguard's low cost is achieved 3 ways: Modular construction permits control of as few as four points or as many as are needed. Installation costs are 50 per cent less than any previous system—and maintenance is virtually nil.

You'll find it well worth your while to investigate Omniguard—a remarkable development from the world-famous EDISON Laboratory.



Bearing temperature °F.

*This study, published in *Electrical Manufacturing*, shows the effects of temperature vs. fatigue life of a tin-base babbitt sleeve bearing at a unit load of 2000 psi.

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ARGUMENTS

Continued from page 144

What I have been able to learn of our license laws makes it seem that most of them regiment rather than protect. Sometimes you need only know the right persons to pass; otherwise, you may have trouble getting a chance to pass.

When the people who hire operators or engineers—the insurance companies, the various engineering associations and the manufacturers—get together on a national scale, we will have license laws that protect. I think a Federal law is needed for uniform protection.

CLYDE HOWARTER *Canton, Ill.*

Bilge water on existing license laws! Let's have a law that's good in any state in the Union and also at sea. If a man is fed up with working as an engineer ashore, let him get a job on a ship, or vice versa, without taking another exam. Otherwise, let's heave all license laws overboard!

MORLEY WIGLEY *Oradell, N. J.*

SCREENLESS INTAKE

Continued from page 81

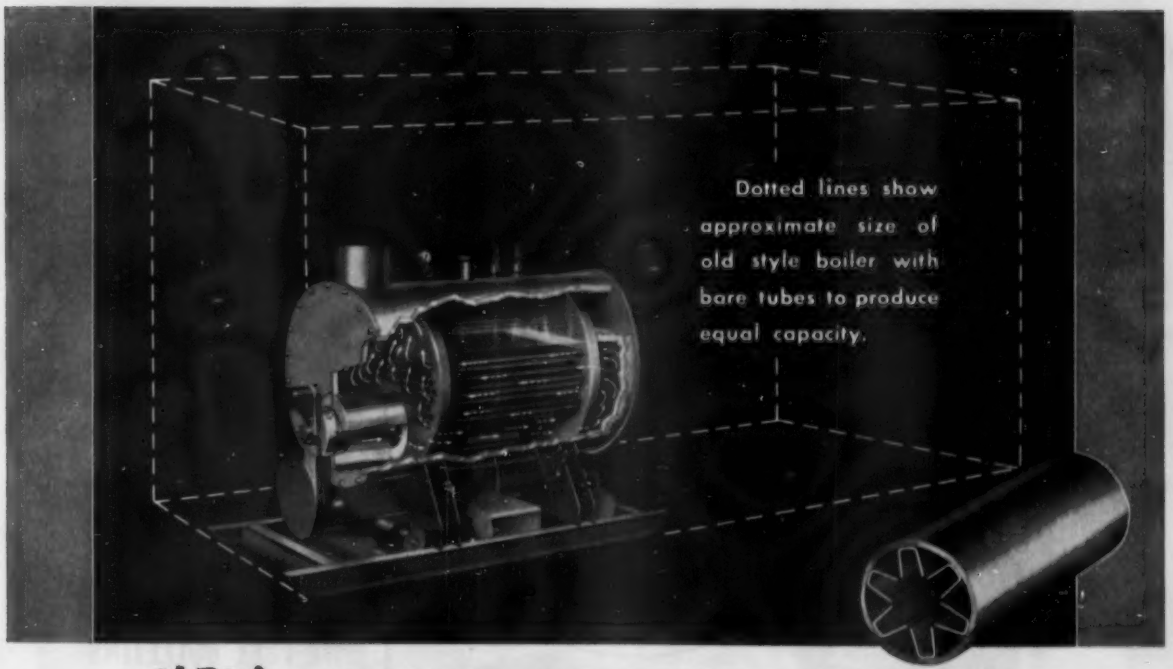
at the center of the square. This arrangement prevents debris on the lake bottom and on the surface from entering the pipe. Any debris passing through the pumps, and not the ¾-in. tubes, remains on the condenser tube sheet. As debris accumulates the flow decreases. This actuates a differential-temperature controller that reverses the water valves to flush the tube sheet clear.

Coincidence. The siphon-system intake combines with the screenless feature purely by coincidence. The two were entirely separate problems. Existing intakes were not big enough to supply the new 100-mw unit. The new line can supply double the amout needed with conservative velocities.

We had trouble with joint separation in the original two gravity-intake lines extending into the lake. This showed we needed a structural base to support a buried line. Costs of an overhead siphon line were a standoff compared to a gravity-intake line. Since the overhead line can be easily reached for repairs, we chose it.

A conventional pressure intake line, above or below ground, would have been somewhat less expensive. But it would need a pump and screen house at the lake shore about 1300 ft from the station. Having pumps this far from the station would be undesirable for both operation and maintenance.

Vacuum pumps remove air from the 84-in.-diameter line. It takes five to six



NEW BROWN FINTUBE BOILER

uses *Internally Finned* boiler tubes

to produce more steam from much less space

A Brown Fintube Boiler—size for size—is about ⅔ as wide, ½ as long and ⅔ as high as a conventional bare tube boiler of equal capacity.

Of new design throughout, this boiler reflects the company's more than 17 years of outstandingly successful experience applying the advantages of extended surface finned tubes to the chemical and petroleum industries. Now — for the first time — the same proven advantages of extended surface finned tubes have been applied to boilers, where the use of finned tubing offers so many advantages.

Our internally finned tubes have 3 times more fire-side surface than plain bare tubes, to pick up heat and transfer it to the water; create greater turbulence; and bring the hot gases in more intimate contact with the heat transfer surface. Consequently, we extract the maximum amount of heat, consistent with good combustion practice, in just *one pass* through a *short tube* — thus eliminating the need for big, heavy assemblies, and reducing the forced draft and stack requirements.

Before you buy anything else be sure to investigate fully the newest, most modern, and most efficient boiler on the market today. Write now for a copy of Bulletin No. 542. It gives full details, tells why finned tubes transfer heat better than just plain bare tubes. *Write* for your copy of Bulletin No. 542 *today.*

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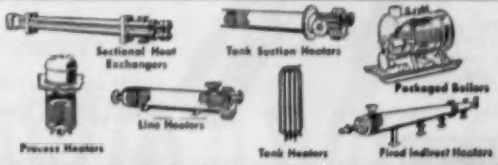

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Clean tubes and pipes from ½" to 12" I.D. THOROUGHLY QUICKLY

ROTOJET Model 512 Air-driven Motor, universal joint, swing-frame head, and solid brush.

ROTOJET Junior Model 532 Air-driven Motor, universal joint, zone cutter.

ROTOJET Junior Model C434 Air-driven Motor flexible coupling, expanding brush.

ROTOJET Model C-525 Air-driven Motor with swing-frame head and universal joint.

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Our large stock of Rotojet air-driven and water-driven tube cleaners, accessories, and repair parts for straight and curved tubes, pipes, and transfer lines is available to meet most requirements without delay. Tube cleaner specialization for 43 years assures satisfactory results from any Rotojet equipment we recommend. Send for Bulletins J-410 and R-105. For quick action wire or phone, HUmboldt 3-0570.

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SCREENLESS INTAKE

Continued from page 228

hours to evacuate the 1872 feet of line and prime the pumps for an initial start-up. After establishing water flow, one pump alone can remove entrained air from the system.

We had to increase the closing speed of the circulating pump discharge valves. Taking or tripping out one pump permitted reversal of water flow and loss of water to the condenser because of the long closing time. New air-operated cylinders now close the valves in a fraction of the original time.

We are satisfied, after a year's operating experience, that our decisions to eliminate traveling screens and use a siphon system were well founded. They have yielded considerable savings.

More FREE BULLETINS

Begins on page 171

CONTROLS-MECHANICAL, ELECTRIC

14 **Liquid level controls,** single or multi-level stage. Illustrated 12-page bulletin VI describes units with semi-steel chambers for operation to 400 psi at temperatures to 100 F; and units with steel chambers designed for pressures to 5000 psi. Magnetrol Inc, 2110 S Marshall Blvd, Chicago 23, Ill.

15 **Circuit breakers.** Steel-clad impulse oil units, in ratings of 138, 161, 230 and 330 kv, described in illustrated 16-page bulletin GEA-6157. Includes data on installation and maintenance, dimensions and accessories. General Electric Co, Schenectady 5, N. Y.

16 **Subway oil switches.** 3-pole non-automatic controls for sectionalising lines, switching of transformers, or similar services. Design features of *Type M-25*, rated 300 amps, 5000 v; and *Type M-50* rated 400 amps, 7500 v, in illustrated 4-page bulletin 71B6101B. Allis-Chalmers Manufacturing Co, 952 S 70th St, Milwaukee, Wisconsin.

17 **Load tap changing equipment.** Most common applications are as step voltage regulator, regulating transformer, or local ratio control transformer. Operating principles, construction data, photos, sketches in 30-page bulletin LTC-2907. Moloney Electric Co, St Louis 20, Missouri.

ELECTRICAL EQUIPMENT

18 **Vertical motors,** grease and oil lubricated types in ratings from ¼ to 400 hp. Cutaways, photos, specs in bulletin 1868. U.S. Electrical Motors Inc, Box 2058, Los Angeles 54, Calif.

19 **Magnetic amplifiers** with power output of 0.03 to 325 w, 6.3 to 230 v, 0.015 to 1.7 amps. Photos, typical applications, operating characteristics in 20-page bulletin 52-600. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pennsylvania.

20 **Rubber-insulated cables** to be used in racks or trays for applications where rigid conduit systems are unnecessary. This cable may be operated at conductor temperatures to 85 C both indoors and outdoors at voltages to 15 kv. Drawings, dimensions, capacities in 36-page bulletin 1090. The Okonite Co, Passaic, N. J.

21 **Unit substations.** Installation and operating data: descriptions of high voltage section equipment, trans-

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

FIG. 3031 WE—Steel O.S. & Y. Globe Valve For 300 Pounds W.S.P.

FIG. 11303—1500-Pound Pressure Seal Steel Gate Valve.

FIG. 1331-A—1500-Pound Steel Integral Bonnet Offset Globe Valve.

FIG. 3059-G—300-Pound Steel Lubricated Plug Valve. Gear Operated.

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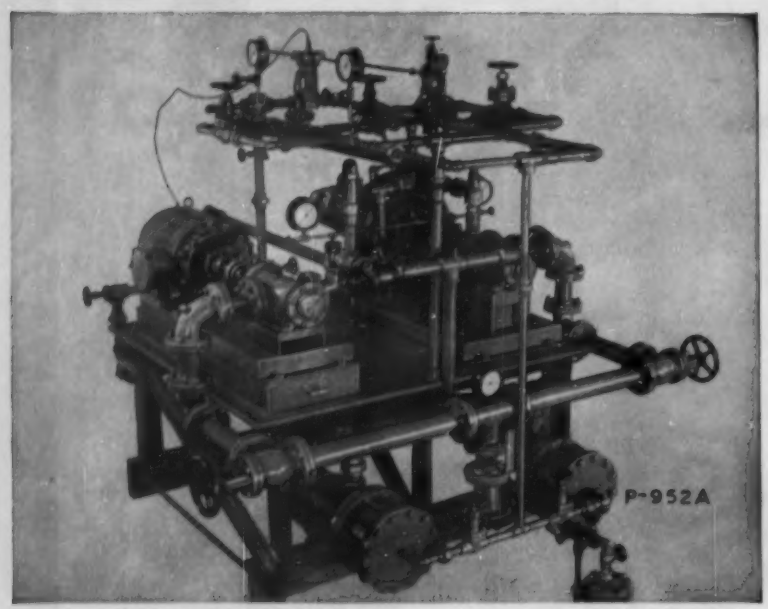

P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-852H size No. 25 unit.

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More FREE BULLETINS

Begins on page 171

formers, and low voltage switchgear in 16-page bulletin 102. Continental Electric Equipment Co, Box 1055, Cincinnati 1, Ohio.

CONDENSERS, HEAT EXCHANGERS

22 **Steam condensers.** Installations, engr data, air removal equipment, maintenance, specialties in heavily illustrated 24-page bulletin. Condenser Service & Engineering Co, Inc, Observer Highway, Hoboken, New Jersey.

23 **Heat exchangers** as applied to controlled temperature cooling of water, oil and other liquids and gases. Illustrated 2-page bulletin 124. Niagara Blower Co, 405 Lexington Ave, New York 17, New York.

INSULATION

24 **Cellular glass insulation,** *Foamglas* for roofs, ceilings, walls, floors, cold storage spaces, piping, tanks and equipment. Photos, applications, typical installations, physical properties in bulletin FG-101. Pittsburgh Corning Corp, 1 Gateway Center, Pittsburgh 22, Pennsylvania.

25 **Sheet insulation,** *Marinite* for driers, ovens, breechings, housings. Used for both building and insulating. Physical and thermal properties, handling and working recommendations, in illustrated 16-page bulletin. Johns-Manville, 22 E 40th St, New York 16, New York.

MAINTENANCE EQUIPMENT AND MATERIALS

26 **Filter facts,** no. 1, a 12-page engr paper designed to aid the engine manufacturer and operator. Subjects covered include the lubricating system, filter materials and construction. Engine Life Products Corp, El Monte, California.

27 **O-rings** for dynamic sealing and static gasketing. Design and dimensional data, typical applications in 20-page bulletin AD-148. The Garlock Packing Co, Palmyra, New York.

28 **Cleaning system.** Syphon jet vacuum unit is non-electric, multi-purpose cleaner that utilizes compressed air from the user's source. Basic cleaning techniques, operational data in 4-page bulletin 50. Wilson Engineering Corp, 122 S Michigan Ave, Chicago 3, Illinois.

29 **Lubricating system** provides centralized lubrication for as many as 12 bearings. Operational data in illustrated 8-page bulletin 16. The Farval Corp, 3261 E 80th St, Cleveland 4, Ohio.

30 **Silicone grease** for high temperature, slow speed bearings. Performance data, applications, case histories in illustrated 6-page bulletin. Dow-Corning Corp, Midland, Michigan.

31 **Thread compound,** recommended for use at temperatures to 1800 F. Advantages, chemical properties, applications in 2-page bulletin C-5. Felt Products Mfg Co, 1539 Carroll Ave, Chicago 7, Illinois.

MATERIALS HANDLING

32 **Vibrating screens** are used for scalping, sizing, dewatering and rinsing. Engr data, capacity charts, selection info in illustrated 12-page bulletin 2554. Link-Belt Co, Dept PR, 307 N Michigan Ave, Chicago 1, Illinois.

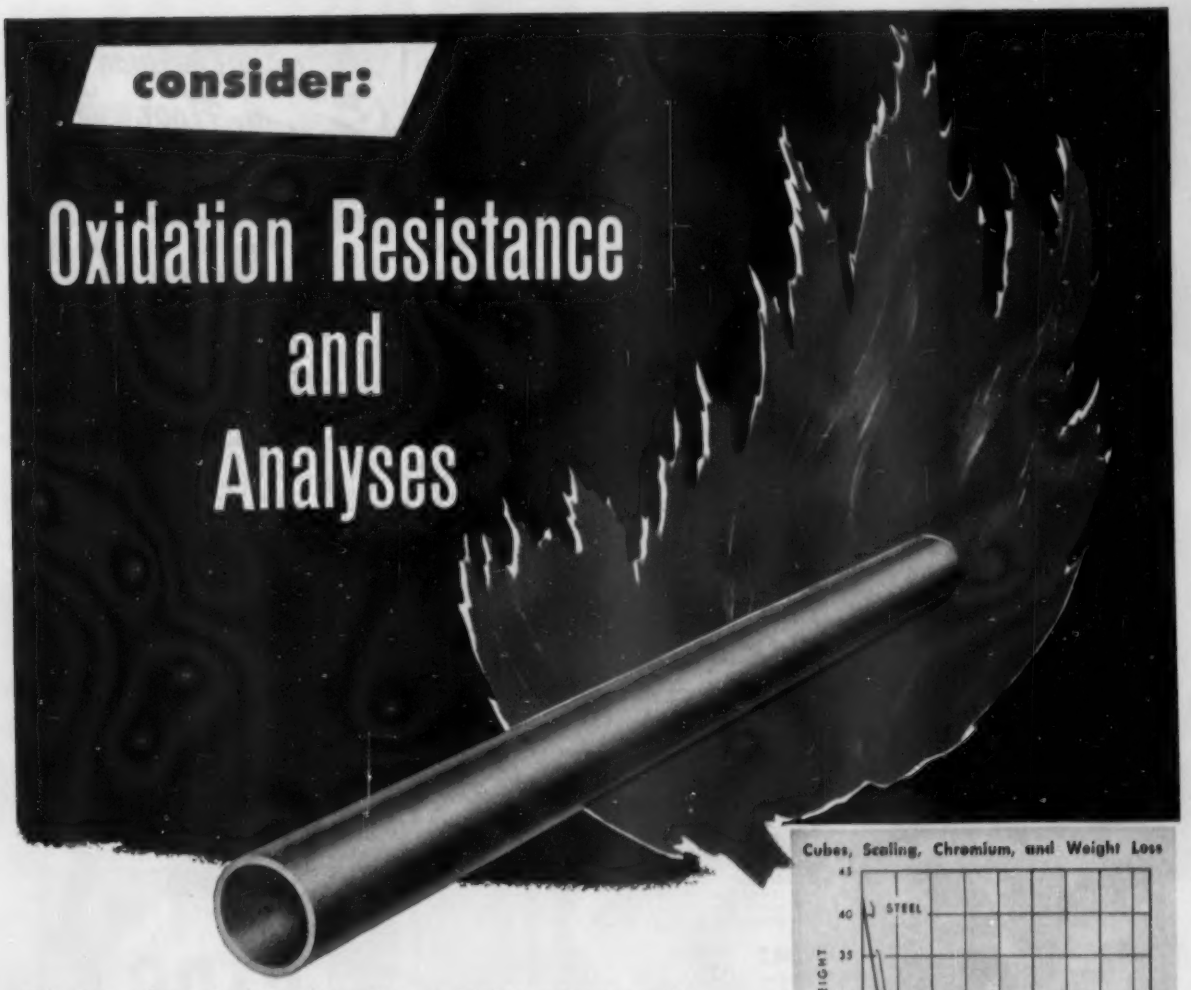
33 **Wire rope assemblies** for use with slings and hoists or as part of machinery and equipment. Dimensions, specs, photos, schematic drawings in 22-page bulletin 5201. Macwhyte Co, Kenosha, Wisconsin.

34 **Electrification systems.** Enclosed trolley busway units available in 60, 100, 225, 375 and 600 amp capacities. Operational data, applications in illustrated 4-page bulletin 44. Feedrail Corp, 125 Barclay St, New York 7, N. Y.

(Continued on page 234)

consider:

Oxidation Resistance and Analyses

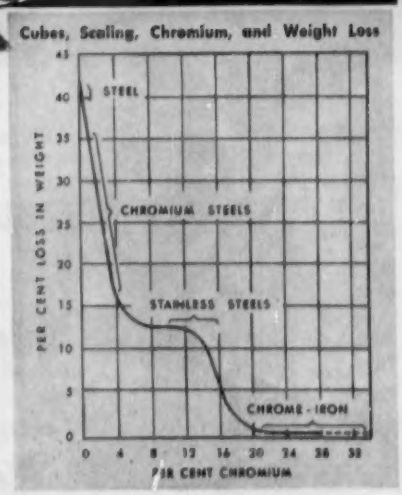


The loss of metal, through scaling, at high temperatures is a costly phenomenon that must be considered in the selection of stainless tubing where conditions of extended excessive temperatures are present.

When choosing a specific Croloy for your operation it is well to review the factors that govern the service life of the tube. For example, B&W Croloy 18-8S (AISI Type 304) can operate, without excessive scaling, at a maximum temperature of 1650 F. Here, as in most other cases, the temperature limit may have to be revised downward should combustion products or gases high in sulphur compounds or vanadium-containing ash be present.

This is but one general example of the intricacies involved in choosing the proper stainless tubing for a specific use. For virtually any application B&W can provide either seamless or welded stainless tubing in any number of grades, in a broad size range. Help in obtaining the best stainless tubing —pressure or mechanical—for your applications is available through B&W Regional Sales Offices and a nationwide network of experienced tubing distributors. Mr. Tubes—your link to B&W—will be pleased to furnish detailed answers to your stainless tubing problems.

TA-4058(SSM)



Many tests have been made under different temperatures with steels having various chromium content to determine their resistance to oxidation. Chart above clearly explains what happens — oxidationwise —to metals when exposed to a temperature of 1835 F for 48 hours.

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
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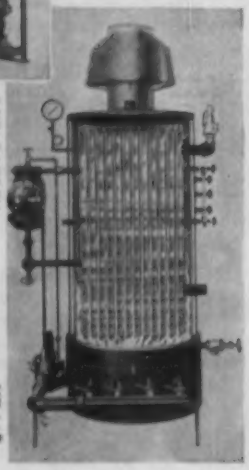
...USE A KANE VERTICAL BOILER PACKAGE

. . . chances are that floor space is at a premium in your shop or plant . . . if so, you needn't be robbed of this valuable space by a cumbersome, horizontal type boiler . . . not when a KANE *vertical* BOILER PACKAGE will give you the same or probably better results.

The KANE BOILER PACKAGE includes: the correctly sized Automatic Gas-Fired Boiler complete with gas burner and controls to maintain required steam pressure; and an M-K-O Automatic Boiler Feed system designed to return condensate and supply make-up water as required for highest operating efficiency.

"Engineered Steam at its best, with over 50 years of experience at your disposal!"

Full details in new KANE Bulletin, No. 2K.



The M-K-O Automatic Boiler Feed returns condensate and supplies make-up water as needed to the KANE boiler.

The KANE Boiler, built to A.S.M.E. specifications, in sizes to 30 H.P.

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More FREE BULLETINS

Begins on page 171

35 **Proportioning system** permits remote dialing of individual ingredient weights. Photos, engr drawings, design, operating characteristics, applications in 28-page bulletin 0551. Richardson Scale Co, Van Houten Ave, Clifton, New Jersey.

36 **Handling and heating** of residual fuel oils for use in processing equipment, boilers and furnaces. Schematic drawings, complete descriptions in bulletin 1601. Preferred Utilities Mfg Corp, 1860 Broadway, New York 23, New York.

MECHANICAL TRANSMISSION

37 **Torque converters** for engines from 15 to 600 hp. Photos, cutaway drawings, construction data, specs in 8-page bulletin J-50. Clark Equipment Co, Transmission div, Fallshee Rd, Jackson, Michigan.

38 **Gear drives.** Parallel shaft units —single, double and triple reduction drives—permit ratio selections from 1.3:1 to 323:1, with hp capacities over 2000. Engr data, hp tables, dimensions, selection info in illustrated 32-page bulletin 2619. Link-Belt Co, Dept PR, 307 N Michigan Ave, Chicago 1, Ill.

39 **V-belt drives,** bulletin WBC-55-2; speed-reduction drives, bulletin SRC-55-2; flat-belt drives, bulletin FBC-55-2; and conveyor pulleys, bulletin CPC-55-2, contain photos selection and dimensional data. Specify bulletin desired. The American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Pa.

PIPING, VALVES, FITTINGS

40 **Foundation pipe.** Features, selection data, capacities and dimensions, application photos in 8-page bulletin 543. Taylor Forge & Pipe Works, Box 485, Chicago 90, Illinois.

41 **Power piping.** Illustrated 12-page bulletin includes data on methods of stress analysis, metallurgical research, welding methods, special heat treatment techniques. Fabricated Products div, The M W Kellogg Co, 225 Broadway, New York 7, New York.

42 **Tubing.** Data on selection and application of 46 principal analyses of tubing is presented in 8-page bulletin 40. Superior Tube Co, 1778 Germantown Pike, Norristown, Pa.

43 **Fluid control valves** for use in instrumentation, refineries, air circuit work, vacuum systems and pressure flow control. Photos, specs, capacities in 12-page bulletin 3037. The Imperial Brass Mfg Co, 1200 W Harrison St, Chicago 7, Illinois.

44 **Butterfly valves** for operating temperatures of —20 to 190 F. Low-pressure units described in bulletin 1. High-pressure units, guaranteed drop-tight at pressure conditions from vacuum to 125 psi, described in bulletin 4. Specify bulletin desired. The Henry Pratt Co, 2222 S Halsted St, Chicago 8, Illinois.

45 **Electric check valve.** Dimensions, cross-sectional views, parts list, suggested wiring and diagrams, full specs in 8-page technical bulletin W-10. Golden-Anderson Valve Specialty Co, 1241 Ridge Ave, Pittsburgh 33, Pa.

★ **Hose and fittings** for industrial use. Tabbed pages of 132-page catalog indicate sections covering brass tube fittings, drain and shut-off cocks, SAE 37 deg flare fittings, steel and stainless steel fittings, bulk hose and reusable ends, hose assemblies. ★Request "Yellow Book" direct from The Weatherhead Co, 300 E 131st St, Cleveland 8, Ohio.

PRIME MOVERS AND ACCESSORIES

46 **Turbine-generators,** 2500 to 40,000 kw, for electric utilities and industrial plants. Covers condensing, noncondensing and special applications. Cross-sections, schematic drawings, photos in 54-page booklet GEA-3277C. General Electric Co, Schenectady 5, N.Y.

(Continued on page 236)

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Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

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Range of 10 adjustable sizes fits all valve wheels from 2 to 30 inches diameter, with rising or non-rising stems. Only four simple, quickly-assembled parts.

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Will remove rust and corrosion
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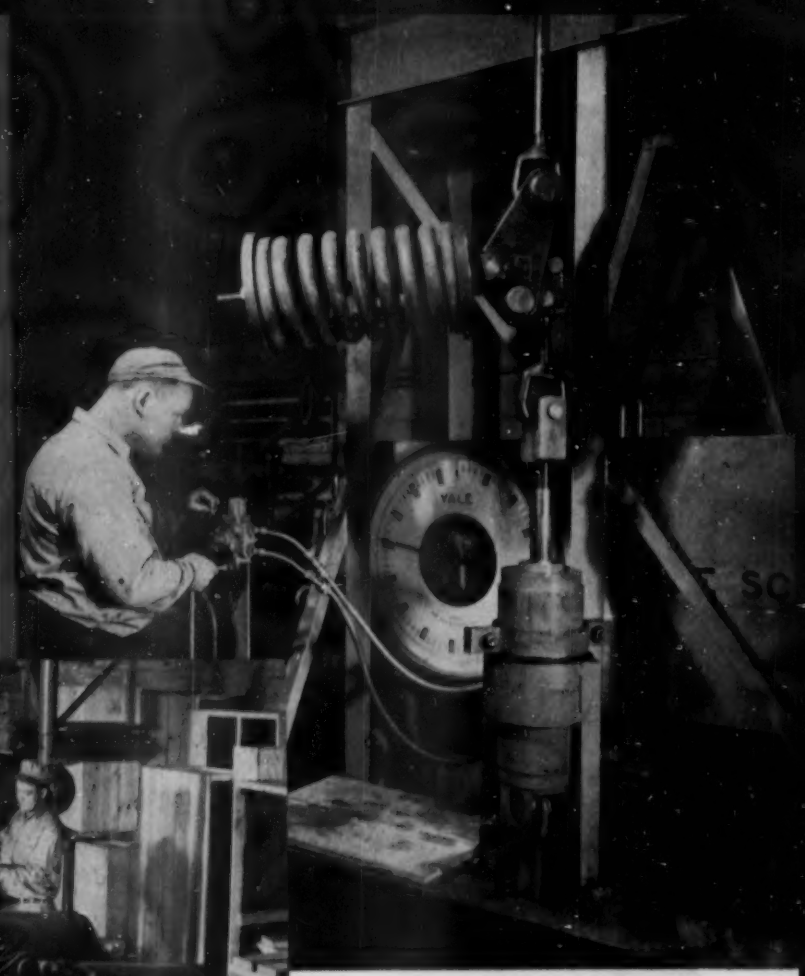
here's how high temperature piping can flex its muscles



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Since high temperature piping has no respect for equipment connections, the entire piping system must flex its muscles to absorb the strain of expansion and contraction. This prevents serious stresses that could endanger the installation.

And how does high temperature piping flex its muscles? With Navco's precision engineered Counterpoise Pipe Hanger—the hanger with a load-supporting effort that is of constant value throughout the range of travel. This permits weightless movement of the entire piping system.

To learn how power plants, oil refineries and chemical plants can have piping systems that flex their muscles, write today for Navco's 12-page Counterpoise hanger bulletin #153.

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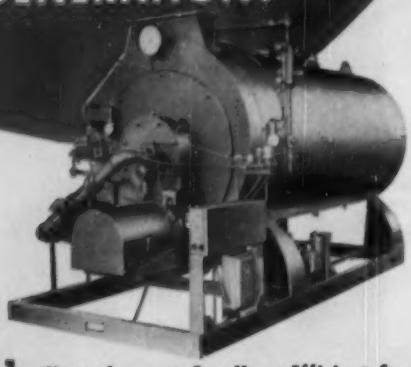

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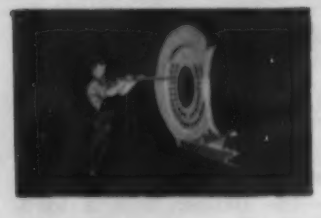

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More FREE BULLETINS

Begins on page 171

47 Steam turbines. Illustrated 8-page bulletin 03R8221 discusses advantages of close-coupled design to reduce floor area of high capability cross-compound reheat steam turbine-generator units. Allis-Chalmers Manufacturing Co, 952 S 70th St, Milwaukee 1, Wisconsin.

48 Diesel engines. Construction details, applications, design features, specs, hp rating chart for 5, 6 and 8 cylinder engines. Illustrated 10-page bulletin S-500-B42B, Worthington Corp, Harrison, New Jersey.

49 Engines with capacities of 115 to 410 hp. Specs, features, typical applications in illustrated 8-page bulletin E-9. Le Roi div, Westinghouse Air Brake Co, 1706 S 68th St, Milwaukee 14, Wisconsin.

PUMPS

★ **Rotary pumps** for all types of industries are described in a series of bound booklets. Included is data on LP-gas, hydraulic, general purpose, heavy-duty, and underwriter pumps. ★For details on these bulletins write direct to Viking Pump Co, Cedar Falls, Iowa.

50 Service pumps, vertical industrial units for liquid transfer from short settings. Capacities range from 30 to 40,000 gpm. Schematic drawings, cutaways, photos in 16-page bulletin B-505. Peerless Pump div, Food Machinery & Chemical Corp, 301 West Avenue 26, Los Angeles 31, California.

51 Centrifugal pumps, two-stage, have horizontally split case and opposed impellers. Specs, mechanical data, performance curves, dimensions in illustrated 12-page bulletin 722.6. Goulds Pumps, Inc, Seneca Falls, N. Y.

52 Steam pumps. Horizontal duplex units have piston valve steam chest. Construction features, sectional and exterior views, specs, capacities, dimensions in 4-page bulletin 230. Warren Steam Pump Co, Inc, Warren, Mass.

53 Double suction pumps. Centrifugal, horizontal split case units have capacities to 4600 gpm against heads to 225 ft. Cutaways, photos, specs, dimensions, typical installations in 8-page bulletin 105-B. Aurora Pump div, New York Air Brake Co, 629 Loucks St, Aurora, Illinois.

54 Controlled capacity pumps, simplex and duplex, have capacities to over 2300 gpm. Bulletin S-1254 includes data on standard units to 1500 psi, and low pressure pumps to 800 psi. Philadelphia Pump & Machinery Co, Inc, 1523 Race St, Philadelphia, Pa.

WATER TREATMENT

55 Iron removal system can handle up to 250 gpm, or be operated in parallel with other units to obtain greater capacities. Photos, diagrams, operational details in 4-page bulletin. Aquatrol Ferr-X Corp, Clifton, N. J.

56 Technical paper entitled "Corrosion by aqueous solutions at elevated temperatures and pressures" is obtainable from Alloy Casting Institute, 32 3rd Ave, Mineola, L. I., N. Y.

57 Flotation unit for clarification, water recovery, product recovery, pollution elimination. Design and operational details, applications, schematic drawing in 4-page bulletin WC-119. Graver Water Conditioning Co, 216 W 14th St, New York 11, New York.

WELDING

58 Welding supplies and accessories. Illustrated 36-page bulletin ADC848 includes data on welding rods, fluxes, brazing alloys, goggles, helmets, shields, cables, lighters, etc. Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.

59 Hardfacing alloys, *Nos. 18 & 118.* Engr. data, photos, applications in 4-page bulletin. Coast Metals, Inc, Little Ferry, New Jersey.

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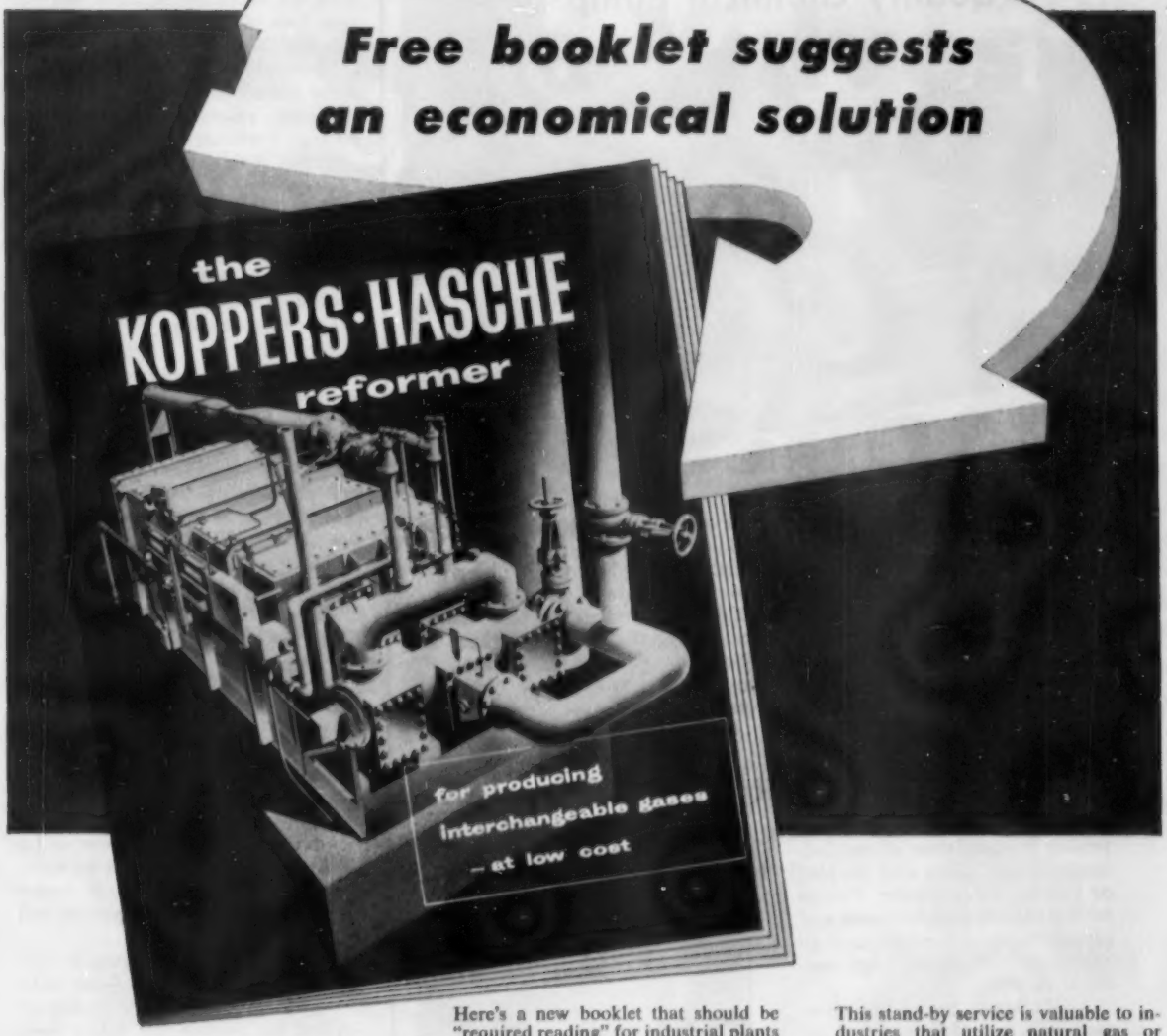
Free booklet suggests an economical solution



Here's a new booklet that should be "required reading" for industrial plants that use gas on an interruptible contract. It describes the Koppers-Hasche Reformer—the reformer that produces low-cost gas that is interchangeable with most natural or manufactured gases.

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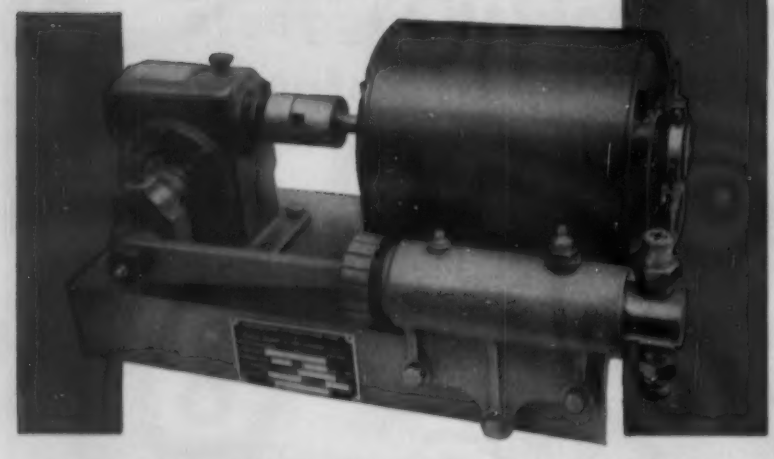

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More TECHNICAL BRIEFS

Begins on page 158

over-all efficiency, moderate cost, low maintenance and minimum downtime.

Efficiency of mechanical rectifiers in these plants is high, about 97%, but there are numerous backfires and outages. Loss of load on a chlorine cell is not desirable, but if the machine can be restored within a few minutes, it is not too detrimental. With diversified continuous processes, it is desirable to maintain a portion of the load.

Studies at this and other plants show that contact replacement is the major maintenance item. Design improvements are necessary and inevitable. The machines must be made more stable during power-system disturbances and faster restoration of load to the unit is a must. *AIEE CP, no number.*

Maintenance of rectifiers and their auxiliaries. *By B J Nankervis, The Dow Chemical Co, Freeport, Texas.*

This company has 8 mercury-arc rectifier stations in Texas containing a total of 43 rectifier units. Total rated capacity of these single-anode ignitron-type units is 267,000 kw.

This paper describes maintenance of these units and their auxiliaries, excluding circulating-water system and heat exchangers. Outage time for 10 months of 1954 for 4 stations (21 rectifiers) from troubles on the rectifiers and their auxiliaries averaged 0.03%, or 2.6 hours per rectifier. This does not include water-system or circuit-breaker troubles.

No spare rectifiers are available, so maintenance is performed during production shutdowns. When operated for a year or longer with little or no maintenance, a unit is taken out of service for 10 to 12 hours for inspection and testing.

One major maintenance item is overhaul of the rectifier tanks. Some tanks have a 13-year operating record without overhaul but average life before overhaul has been 8 years.

Other maintenance items include firing cubicles and vacuum equipment. Maintenance facilities and personnel are discussed. *AIEE CP, no number.*

Steam plants

Typical small and medium steam-plant designs. *By Thomas D Coyne, Gibbs & Hill, Inc.*

Use of coal-fired steam generators in small- and medium-sized industrial plants has been retarded by lack of soundly engineered installations to compete with the preengineered packaged-

Directions for ordering papers on p 246

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More TECHNICAL BRIEFS

Begins on page 158

boiler installations so well developed for oil and gas firing. Two typical plant designs presented in this paper are intended to serve as a guide for better engineering of small coal-burning installations.

Arrangements reflect considerable thought in regard to conservative design, reliability of equipment, minimum operating costs and low initial capital investment. To achieve these goals, equipment was carefully selected from current designs of reputable manufacturers, sized for reliable operation and arranged to promote maximum over-all plant efficiency with minimum operating personnel.

Projects involve 35,000 lb-per-hr and 60,000 lb-per-hr capacity steam-generating units. In each, the plant was designed for initial installation of two boilers but general facilities were developed so a third unit could be added at a relatively low cost.

Total cost of the plants based on two boilers was $7.19 per lb of steam for the 35,000 lb-per-hr units and $6.88 per lb for 60,000 lb-per-hr boilers. For the ultimate three-boiler plants the costs were $6.20 and $6.31 per lb of steam, respectively. *ASME paper no. 54-A-205.*

An investigation of the economic size of steam-electric generating units. *By L K Kirchmaver, A G Mellor, J F O'Mara and J R Stevenson of General Electric Company.*

This paper records method of analysis and results obtained from a study made to determine optimum economic size of steam-electric generating units that should be added to a power system. The study attempts to take into account factors like system size, forced outage rate, rate of load growth, installed cost of larger generating units, effect of maintenance program and effect on transmission system in regard to use of larger generating units.

This study assumes a basic existing system of 2000 mw total generating capability. Results show if investment cost of large units continues to decrease with size and forced outage rate remains as at present (2% or less), most economical pattern of system expansion is to add units of between 10% and 7% of the size of the system studied. Any increase in forced outage rate of larger units slows up the move to these sizes.

For range of rates of load growth normally encountered, rate of load growth of a system has no appreciable effect on size of units that can be economically justified. Based on factors considered in this study, it can be con-

Directions for ordering papers on p 246

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FIG. 21—Lip Mold

FIG. 22—Standard

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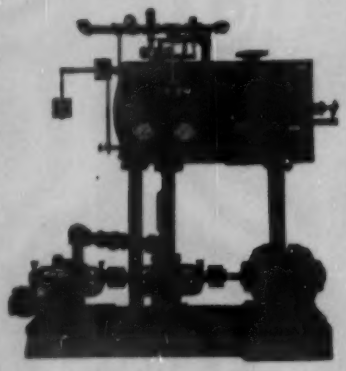
For laundries, dry cleaning plants, food processing plants, sand drying plants, corrugated box plants, and paper mills using steam at pressures between 50 and 250 pounds.

The Stickle differential drainage and boiler return system is a closed pumping system for returning condensation from heating and processing equipment under pressure directly to the boiler. Condensate reaches the boiler at a temperature of 300 degrees or higher—only 15 to 20 degrees lower than temperature of steam at operating pressure—thus saving steam and fuel . . . and increasing efficiency. Users report that the system. . . .



1. Reduces fuel costs 10% to 25% by completely salvaging condensate and returning it under pressure directly to boiler at 300 degrees temperature or higher—only 15 to 20 degrees less than temperature of steam at operating pressure.
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3. Reduces 85% to 90% use of raw make-up water, its scale-forming particles and strain on boiler caused by cold water.
4. Reduces maintenance costs—on boilers, steam lines, traps, and valves—by eliminating high velocities and by reducing scale.
5. Reduces waste, spoilage and rejects by automatically maintaining the maximum temperature desired within each processing unit.
6. Reduces up to 75% the power used for pumping, since the system requires only 25 pounds pressure differential between supply and return lines.
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8. Eliminates flash steam waste.

Some users report that direct savings have paid for the Stickle system within the first year. Definite results, based on a Stickle survey, are guaranteed. Installation can be made without interrupting operations. Write or wire for details and free Bulletin 250.

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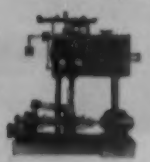


Differential Drainage and Boiler Return Systems

More TECHNICAL BRIEFS

Begins on page 158

servatively estimated that unit sizes of 500 to 600 mw will be used on some power systems within the next 10 years. *AIEE paper, no. 55-183.*

Steam turbines

Close-coupled cross-compound arrangement for compact large capability steam-turbine-generator units. *By Charles D Wilson, Allis Chalmers Manufacturing Co.*

In recent years, there has been a rapid growth of electric-power generating capacity of public utilities, with an inevitable demand for units of larger and larger capability. Accumulation of design and operating experience points to the cross-compound steam turbine as best suited to meet requirements of larger capability units. Inherent advantages of close-coupled cross-compound arrangement make it ideal for such use.

The 1800-rpm low-pressure turbine provides optimum size of exhaust blading required for efficient performance of a large machine. Moderate-size generators can be used on units of very large capability.

When exhaust pressure is 1 in. Hg or less, the cross-compound unit is attractive for ratings of 150 mw and larger. At exhaust pressures of 1.5 in. Hg or less, the cross-compound unit can be effectively applied for ratings of 200 mw and larger.

At the present state of development of 3600-rpm low-pressure exhaust blades, the cross-compound design will be required, with few exceptions, for all units of 300 mw capability and larger. *ASME paper no. 54-182.*

Evaluation of nonflammable fluids as steam-turbine lubricants. *By Dr. G V Browning and Peter G Ipsen, General Electric Co.*

Lube oil of the type used in steam turbines ignites when it contacts metal at a temperature of about 670 F, or higher. Today steam temperatures of 1000 and 1050 F are relatively common. With higher steam temperatures, more areas of the turbine are hot enough to cause spontaneous ignition of any oil that escapes from the system. Since larger turbines are fitted with greater capacity oil systems, there is more oil to burn, increasing the seriousness of a fire.

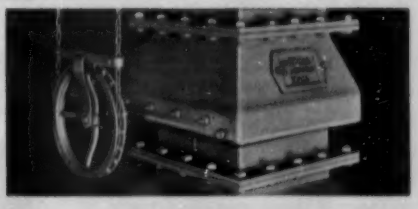
Present arrangements to protect against fires are rather costly and, in some cases, make maintenance more difficult. If a suitable nonflammable lubricating and hydraulic fluid could be

Directions for ordering papers on page 246

Any way you look at it...

you get more value when you

buy the New S·E·CO. Coal Valve



Any way you look at it the new S-E-Co. Coal Valve gives you more value . . . more life expectancy . . . more dependability . . . more ease of operation.

More life because of its heavy construction. The body is made of ⅜" thick steel with ¾" thick flanges. More life because stainless steel is used to combat corrosion — as gate liner, for pinions, gate rollers and grease seal retainers.

More dependability of operation due to the unique ladder racks and multiple faced pinions, both of which are self-cleaning so that tooth engagement is sure. More dependability since two racks are used, one on each side of gate, located far above normal coal flow, to assure straight line gate movement without jamming or binding.

More ease of operation due to large gate supporting rollers equipped with ball bearings and grease seals for pressure lubrication from outside the valve body.

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More TECHNICAL BRIEFS

Begins on page 158

developed, much simplification of the present arrangement and piping system would be possible. Also, costly fire-protection systems installed around the turbine in many power stations would be unnecessary.

Certain fluids, now available, suffice on the basis of nonflammability. *ASME paper no. 54-F-36.*

EDITOR'S NOTE: *For latest thinking on fire-resistant turbine oils, see* POWER, *March '55, pp 75-79.*

Blowing out main turbine steam lines before initial operation. *Edison Electric Institute.*

Cleaning main steam lines by blowing them out with steam prior to initial turbine operation has become increasingly important. Blowing with compressed air or inspecting for cleanliness generally does not produce satisfactory results.

One turbine manufacturer has numerous photographs showing steam-path appearance of units in operation a year or less. Steam paths in some of these turbines appear like those in 15- to 20-year old units—a result of the shotblast effect caused by fine particles. A few companies have had to make expensive repairs on valve seats, nozzles, blading or seals.

This report is a digest of practices of 41 companies that recently cleaned main steam lines of 17 nonreheat and 24 reheat units by blowing them out before initial operation. All but two used steam as the exclusive blowing medium. One made a preliminary blow with compressed air before blowing with steam; another used only air.

All 41 companies state that blowing is a practical cleaning method but some indicated the results have not been entirely satisfactory. Though all companies plan to continue the practice, many contemplate procedure changes. A large number of piping diagrams are included in the report, showing hookups used.

Materials found in the piping include pieces of weld beads, steel curls, general construction debris, slag, welding rod, nails, boiler-tube cap, bottle caps and a piece of hacksaw blade. *EEI publication no. 54-17.*

Power distribution

Some fundamentals of equipment grounding circuit design. *By R H Kaufmann, General Electric Co.*

An effective equipment grounding system should, under conditions of maximum ground-fault current flow, accomplish the following objectives: (1) maintain a low potential difference (perhaps

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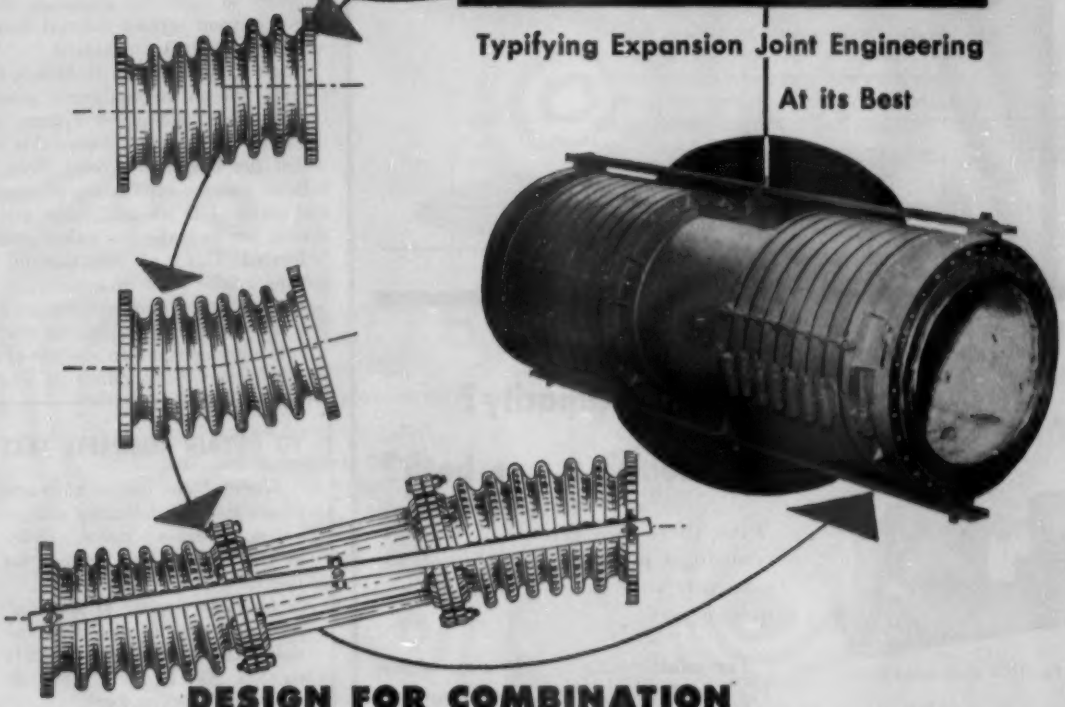

DESIGN FOR COMBINATION LINEAR-SHEAR-LATERAL MOVEMENTS

Study these sketches showing (somewhat exaggerated, of course) several of the more complex movements to which expansion joints are often subjected. Do you have such pipe line conditions? Do you have any installation coming up that might involve such movements?

Here's the Badger Joint that is designed for just such a problem: the TANDEM JOINT. It's available in both Self-Equalizing and Non-Equalizing design. The joint movement is controlled by the tandem bars pivoting on a pin in the connecting nipple. Permissible shear or lateral movement depends upon the overall length as well as the number of corrugations in each unit. Each tandem unit is designed to suit the individual job requirements.

The Tandem Joint is but one of several special types designed for complex pipe line movements. We'll be glad to study your problem and make recommendations. Should yours be a straight linear traverse—as most installations are—we have a wide range in Directed Flexing, Self-Equalizing and Non-Equalizing Joints made of copper or stainless steel, with flanged or welding ends.

Badger Expansion Joints come in a variety of types and a wide range of sizes: Directed Flexing, Self-Equalizing for longer traverses and higher pressure; Non-Equalizing, for shorter traverse or when pressures are low. Tandem Joints for combination axial and lateral movements; Clevis Joints for angular rotation.

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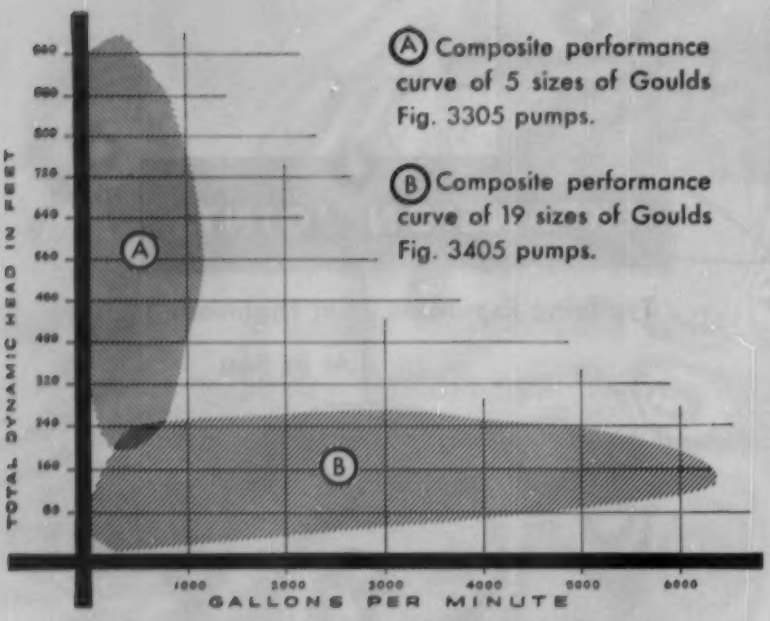

(A) Composite performance curve of 5 sizes of Goulds Fig. 3305 pumps.

(B) Composite performance curve of 19 sizes of Goulds Fig. 3405 pumps.

Do you need **pumping capacity?**

. . . or head? . . . or both?

Goulds Fig. 3405 single-stage pump.

Goulds Fig. 3305 two-stage pump.

With these two groups of Goulds centrifugal pumps you can meet an extremely wide range of pumping requirements.

For volume pumping, 19 sizes of the Fig. 3405 single-stage, double-suction pump provide capacities up to 6,400 GPM, and heads to 280 ft.

For greater pressure requirements 5 sizes of the Fig. 3305 two-stage pump provide heads up to 1,000 ft., and capacities to 1,200 GPM.

Both of these groups of pumps have important new design and construction features that insure efficient operation and long life. Yet, because so many of their parts are interchangeable, *you can cut your parts inventory in two—or better.*

For example, you need only 3 different shafts for all 24 sizes of pumps in both groups.

We'd like to send you additional details about these pumps, including specifications and performance curves. Just write for Bulletin 721.6 about the Fig. 3405 single-stage pumps, and Bulletin 722.6 about the Fig. 3305 two-stage pumps. We'll be glad to send you copies of both.

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More TECHNICAL BRIEFS

Begins on page 158

50-v maximum) between machine frames, equipment enclosures, conductor enclosures, building metallic structure, and metallic components contained therein to avoid electric-shock hazard and unwanted circulating current and (2) incorporate adequate conductance to carry this maximum short-circuit current without thermal distress and the attendant fire hazard.

There is good reason to believe that current flow in the equipment grounding system in a-c power systems will not stray far from the power cable over which the outgoing current flows. It follows that the installation of conductive material in an equipment ground system can be ineffective unless properly located. This is not only wasteful but creates a false sense of security.

This paper presents the results of a special series of full-scale tests dealing with this problem and an analysis of circuit behavior. *AIEE paper no 54-244.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from sources, not POWER.

American Society of Mechanical Engineers. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, New York.

American Institute of Electrical Engineers. Papers, designated "AIEE CP, no. number," may in some cases be obtained from the author, not AIEE. Papers identified by AIEE and number, may be obtained from AIEE, 33 W 39th St, New York 18, New York.

Edison Electric Institute. Identified by initials EEI and obtainable by purchase from EEI, 420 Lexington Ave, New York 17, N. Y.

James B Cunningham, president of Republic Flow Meters Co, and **Alex B Bailey,** retired Commonwealth Edison Co vice-president, have been named co-chairmen of the 75th anniversary meeting of the American Society of Mechanical Engineers. The meeting will be held on Nov 13-18 at the Conrad Hilton Hotel, Chicago, Ill. Cunningham and Bailey are former national presidents of the society and are chairman and vice-chairman, respectively, of the board of trustees of Illinois Institute of Technology.

Special Summer program on "Industrial applications of heat transfer to electronics" will be offered at Massachusetts Institute of Technology from June 14-24.

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As she blinked this terse message, the *USS Nautilus* cast off and steamed to sea leaving an old era of oceanic travel in its wake.

This is the first nuclear-powered, steam-turbine-driven submarine ever to be built. With the eyes of the world watching, it was a project with no margin for failure. Exhaustive sea trials which tested every feature of her equipment proved that the only acceptable result—success—had been completely realized.

We take pride in Walworth's share in this momentous achievement. For, from the days when the *Nautilus* was still on the drawing board to the last stage of construction, Walworth engineers worked directly with the Electric Boat Division of the General Dynamics Corporation—helping with the myriad of piping problems this new concept of transportation posed. Now the *Nautilus* prepares to join the fleet with Walworth Valves and Fittings, both standard and special items, installed.

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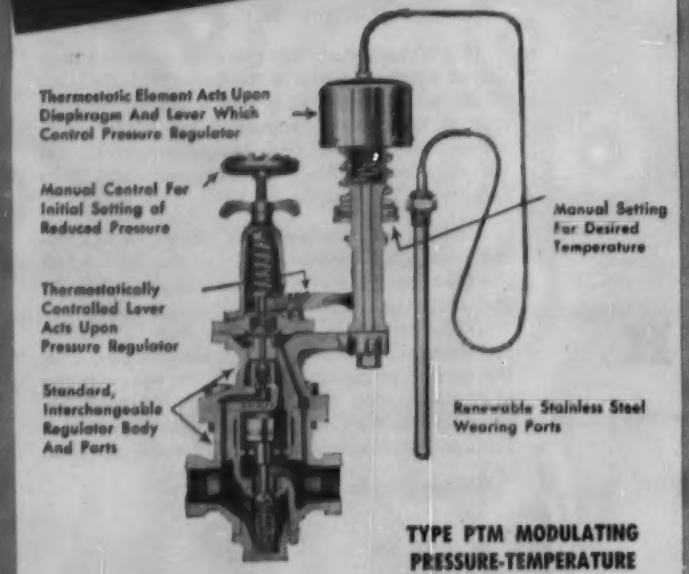

Thermostatic Element Acts Upon Diaphragm And Lever Which Control Pressure Regulator
Manual Control For Initial Setting of Reduced Pressure
Thermostatically Controlled Lever Acts Upon Pressure Regulator
Standard, Interchangeable Regulator Body And Parts
Manual Setting For Desired Temperature
Renewable Stainless Steel Wearing Parts

TYPE PTM MODULATING PRESSURE-TEMPERATURE REGULATOR

Costs No More Than Less Sensitive Separate Units

The new Keckley Type PTM modulating pressure-temperature regulator establishes a new standard of accuracy of temperature regulation for batch processing, air ducts and other exacting control jobs. As temperature tends to vary, the thermostatic control unit acts upon the pressure regulator to reduce or increase steam pressure. Pressure will modulate smoothly and rapidly between the initial setting and zero, thereby preventing overrun. Rate of pressure modulation is adjustable, giving the user a wide choice of control.

This new valve costs no more than separate Pressure and Temperature Regulators but gives much finer control and a simpler installation. Originally developed to meet exacting TVA specifications, Type PTM is a refinement upon earlier Keckley types, which are still catalogued for average requirements.

Ask for your copy of the new Catalog 54-A describing the complete Keckley line of Steam and Liquid Control Equipment.

O. C. KECKLEY COMPANY

400 W. MADISON ST.

CHICAGO 6, ILLINOIS

KECKLEY CHICAGO

Pressure Regulators • Temperature Regulators • Float Valves
Diaphragm Valves • Safety and Relief Valves • Solenoid Valves

More POWER NEWS

Begins on page 156

World Power Conference to be held in Vienna

► "THE SOURCES OF ENERGY of the world in the course of technical and economic development" is the theme of the World Power Conference, to be held in Vienna, Austria, June 17-23, 1956.

Main subjects on the program are: the level of power development in different countries; upgrading of fuel; utilization of primary energy sources; and international cooperation in the field of power production and distribution.

Experts throughout the world have been invited to submit reports to the host committee of Austria through their specific national committees. A simultaneous translation system will transmit all speeches and discussions into English, German and French.

Calendar of Events

Apr 13-15—American Institute of Electrical Engineers, Southern district meeting, Soreno Hotel, St Petersburg, Fla. Full information from AIEE, 33 W 39th St, New York 18, New York.

Apr 18-20—Third National Air Pollution Symposium, Huntington - Shearton Hotel, Pasadena, Calif. Details from Stanford Research Institute, Stanford, Calif.

Apr 19-21 — Oil-Heat Institute of America, Inc, 33rd annual convention. Conrad-Hilton Hotel, Chicago, Ill. Details from OHI, 500 5th Ave, New York 36, N. Y.

Apr 27-29—Society for Experimental Stress Analysis, spring meeting. Hotel Statler, Los Angeles, Calif. Details from W M Murray, SESA, Box 168, Central Square Station, Cambridge 39, Mass.

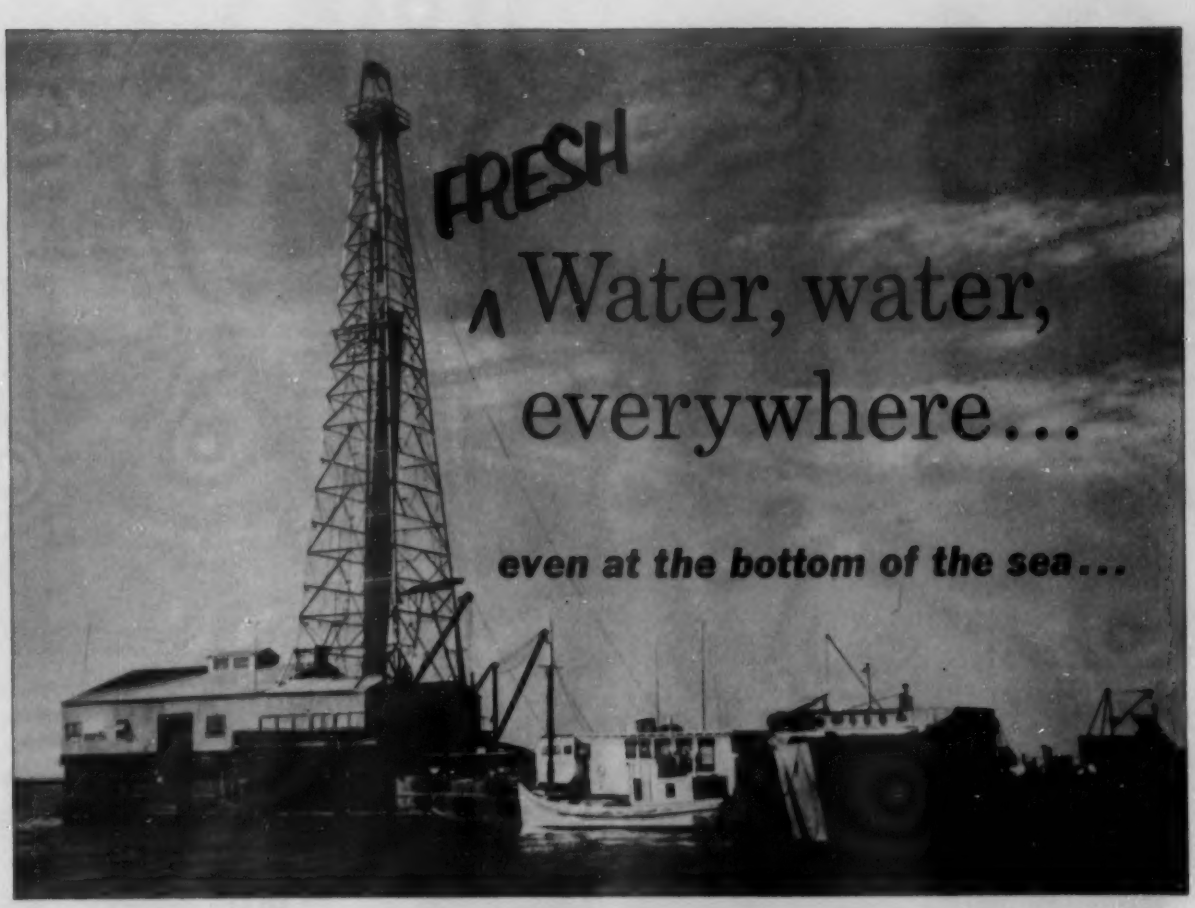
May 4-6—American Institute of Electrical Engineers, Middle-Eastern district meeting, Deshler-Hilton Hotel, Columbus, Ohio. Details from AIEE, 33 W 39th St, New York 18, New York.

May 18-20—American Institute of Electrical Engineers, telemetering conference. Hotel Morrison, Chicago, Ill. Details from AIEE, 33 W 39th St, New York 18, New York.

May 22-26—Air Pollution Control Association, 48th annual meeting, Detroit, Michigan. Information from APCA, 4400 5th Ave, Pittsburgh 13, Pennsylvania.

May 30-June 10—Canadian International Trade Fair. Toronto, Canada. Details from CITF, Exhibition Park, Toronto, Ontario, Canada.

June 7-10—American Welding Society, national spring meeting. Hotel Muehle-



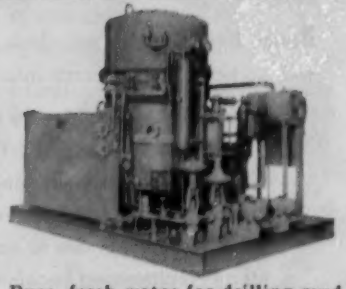
with BRIDGEPORT CONDENSER TUBES

Distilling fresh water from the sea is one of many services Bridgeport Condenser Tubes perform dependably and economically.

The reason is simple, and important. Bridgeport Tube Alloys are carefully selected to meet the conditions in each application... assuring you the most effective performance possible over the longest time. The *right* alloy handles each job, whether in marine or stationary power plants, chemical or process plants, refineries or off-shore drilling rigs.

You get the biggest return possible, in terms of service, from your condenser tube dollars.

Bridgeport Technical Service will be glad to analyze your application and recommend the Bridgeport Condenser or Duplex Tube best suited to your operating conditions.



Pure, fresh water for drilling mud make-up, engine cooling, and drinking is distilled from the sea on this rig by a Cleaver-Brooks Sea Water Evaporator equipped with Bridgeport Arsenical Admiralty Condenser Tubes.

BRIDGEPORT BRASS COMPANY ◆ **BRIDGEPORT, CONNECTICUT**

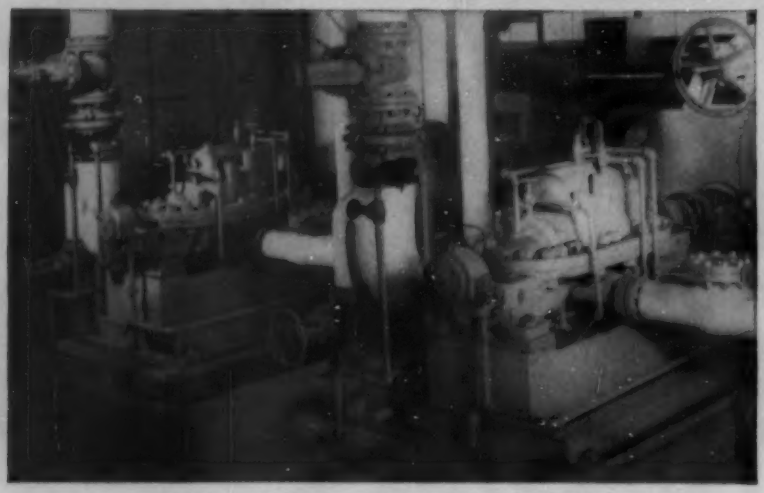
Serving Industry with a Nationwide Network of Conveniently Located Sales Offices and Warehouses.

Mills at Bridgeport, Conn., Indianapolis, Ind., and Adrian, Mich.

In Canada: Noranda Copper and Brass Limited, Montreal

PRODUCTION CONTINUITY

Begins in the Boiler Plant



Warren Six Stage Boiler Feed Pumps installed at a Southern Board and Paper Mill.

Boiler Feed Pumps may look much alike, type for type, but it is well to keep in mind such intangible factors as:

- Experience and integrity of the manufacturer
- Dependability of product
- Know-how, Workmanship, Service
- Maintenance and Repairs
- Lost production due to down-time
- Early replacement because of "tight" original recommendations

It is impossible, of course, to get these items into your "specs," or the supplier into his "quotes," but don't overlook their importance with relation to price, possible future requirements and *production continuity*.

Get your share of "intangibles" . . . specify

WARREN QUIMBY PUMPS

P-55

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.

Warren, Massachusetts

More POWER NEWS

Begins on page 156

bach, Kansas City, Mo. To be held in conjunction with annual Welding Show at Municipal Auditorium, Kansas City, on June 8-10. Details from Banner & Grief, 18 E 41st St, New York 17, New York.

June 14-16—American Institute of Electrical Engineers, in cooperation with American Physical Society and American Institute of Mining and Metallurgical Engineers, magnetics conference and exhibition. William Penn Hotel, Pittsburgh, Pa. Details from Richard Rimback Associates, 845 Ridge Ave, Pittsburgh 12, Pa.

June 20-24—American Society for Engineering Education, 63rd annual meeting. Pennsylvania State University, State College, Pa. Details from Prof K L Holderman, general chairman, 103 Mechanical Engineering Bldg, The Pennsylvania State University, State College, Pa.

June 26-July 1—American Society for Testing Materials, 58th annual meeting. Chalfonte-Haddon Hall, Atlantic City, N. J. Details from ASTM, 1916 Race St, Philadelphia 3, Pennsylvania.

Design Engineering Show postponed to Spring, 1956

► The Design Engineering Show, scheduled to be held in Philadelphia in May, has been postponed until late Spring in 1956. The announcement was made by Clapp & Poliak, Inc, managing firm for the exposition.

Although two successful shows were held under the name of the Basic Materials Exposition, it was decided in January to expand the concept of the exposition and accompanying conference to include all aspects of design engineering. However, sufficient time was found lacking to arrange for necessary changes required by the new concept.

The Chugach Electric Assn, Anchorage, Alaska will add 5000 kw of generation and a new transmission line network to its present facilities. The $6.3 million program, involving hydroelectric development on Kenai Peninsula, will be financed by a $5 million REA loan.

1955 AWARD PROGRAM

Have you recently modernized any of your power services? Tell us about it. You may be in the 1955 award picture. See p 95.

Spiral-Bevel *Cooling* TOWER DRIVE

simple
compact
sturdy
efficient

Here are features which make these single reduction Spiral-Bevel Units outstanding:

- High Efficiency . . . 97, 98% with small heat loss.
- Precision generated Spiral-Bevel Gears, case hardened for long service life.
- Heavy duty housing construction.
- High dome permits mounting fan directly on unit, with ample clearance below fan blades.
- Spiral-bevel pinion is supported by additional outboard bearing, thus preventing any possible pinion deflection.
- Oversize bearings give extra long life.
- Top bearing is continually flooded with oil—no grease fittings are necessary.
- Economical to operate.
- Reducer meets all AGMA standards.

These widely used Cooling Tower Drives are made in 5 sizes, rated from 15 h.p. to 75 h.p. at 1750 r.p.m. motor speed, with Ratios ranging from 3½ to 9½:1.

Be sure your next Cooling Tower is equipped with this dependable Philadelphia Drive. Literature upon request.

Write for Catalog CT-53, which illustrates and fully describes all types of Philadelphia Cooling Tower Drives and their applications: Spiral Bevel, Helical-Spiral Bevel and Worm Gear.

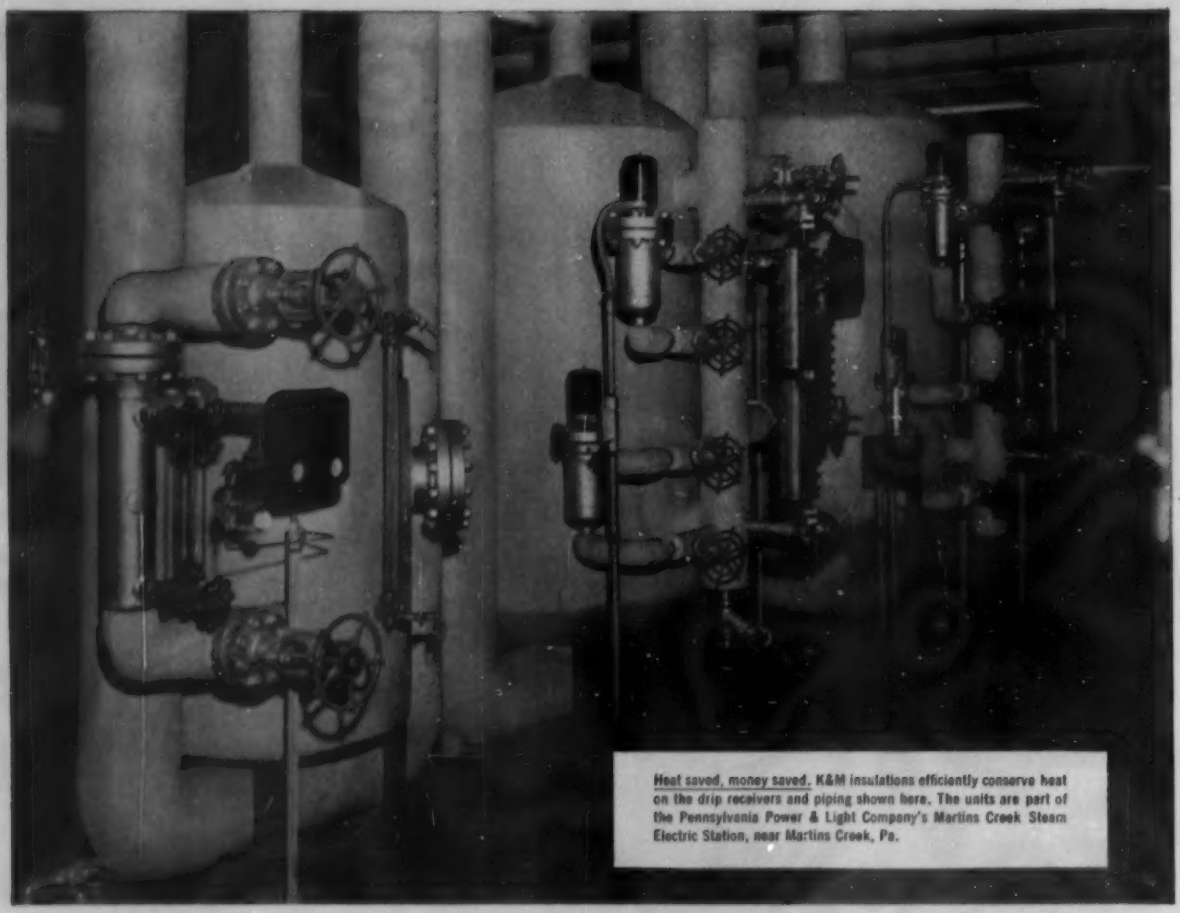
PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
Virginia Gear & Machine Corp., Lynchburg, Va.

Industrial Gears & Speed Reducers

LiniTorque Valve Controls

ESTABLISHED 1892



Heat saved, money saved. K&M insulations efficiently conserve heat on the drip receivers and piping shown here. The units are part of the Pennsylvania Power & Light Company's Martins Creek Steam Electric Station, near Martins Creek, Pa.

Keep Heat Losses Down with

K&M HIGH PRESSURE INSULATIONS!

Efficient heat conservation means *real* dollar savings. Get those savings by using K&M high pressure insulations—known for years for their exceptional efficiency in minimizing heat losses.

K&M "Featherweight"® 85% Magnesia and K&M Hy-Temp Insulation last the life of the equipment they serve. They withstand moisture, vibration, and frequent temperature changes. Both are supplied in various sizes and thicknesses. When used together, these materials—with staggered joints—eliminate the heat loss that normally occurs in single layer installations when expansion causes joints to open.

Efficiency to 1900° F. K&M Hy-Temp Insulation is used on applications where temperatures rise to 1900° F. It's made of diatomaceous silica combined with heat-resistant mineral fillers and asbestos fiber. Usually, it's applied in combination with K&M "Featherweight" 85% Magnesia.

Efficiency to 600°F. K&M "Featherweight" 85% Magnesia is used for effective insulation of piping and equipment with temperatures up to 600° F. 85% of this material is composed of basic carbonate of magnesia, the remainder of asbestos fiber.

Efficiency to 450°F. K&M "Featherweight" Water-Resistant Magnesia Insulation is used on equipment with temperatures up to 450° F. It is especially effective where severe water exposure may damage insulation, or where high humidity and moisture are present.

Act today. Don't let continued heat losses keep operating expenses piling up. Contact your K&M distributor for information on these insulations, or write directly to us.

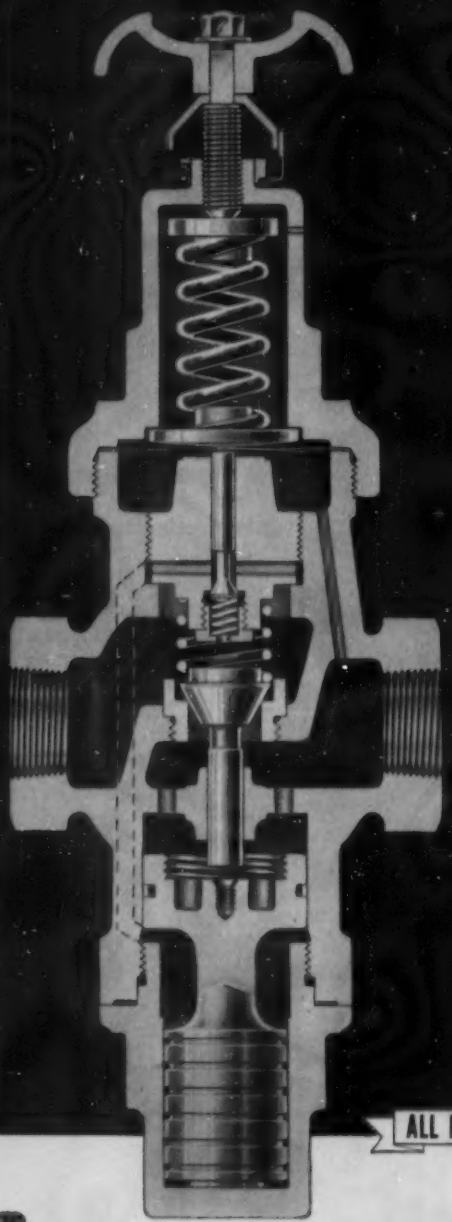
KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®

IN CANADA: ATLAS ASBESTOS COMPANY, LIMITED, MONTREAL, TORONTO, WINNIPEG AND VANCOUVER

MASONEILAN No. 11

FOR STEAM



More

Sensitive Response

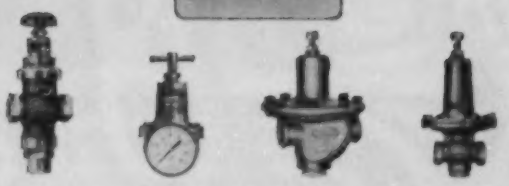
Users report this Masoneilan No. 11 is the most accurate, dependable Pilot Operated Steam Pressure Reducing Valve they've ever used. Superfinished stainless-steel pilot valve, housing, and main valve practically eliminate sticking or corrosion.

Less Maintenance Expense

Service records show maintenance usually consists of little more than keeping the moving parts clean. All parts may be removed and replaced with the valve in the line. A wider range of reduced pressure settings . . . and an unusually sturdy construction — make it the finest, most economical valve in its class.

Available for initial pressures up to 250 psi. Sizes ½" to 2" in bronze; 2½" to 4" iron; or ½" to 3" steel. For more information, write Mason-Neilan Regulator Company, 1186 Adams Street, Boston 24, Mass.

ALL HIGH Quality Coefficient PRODUCTS

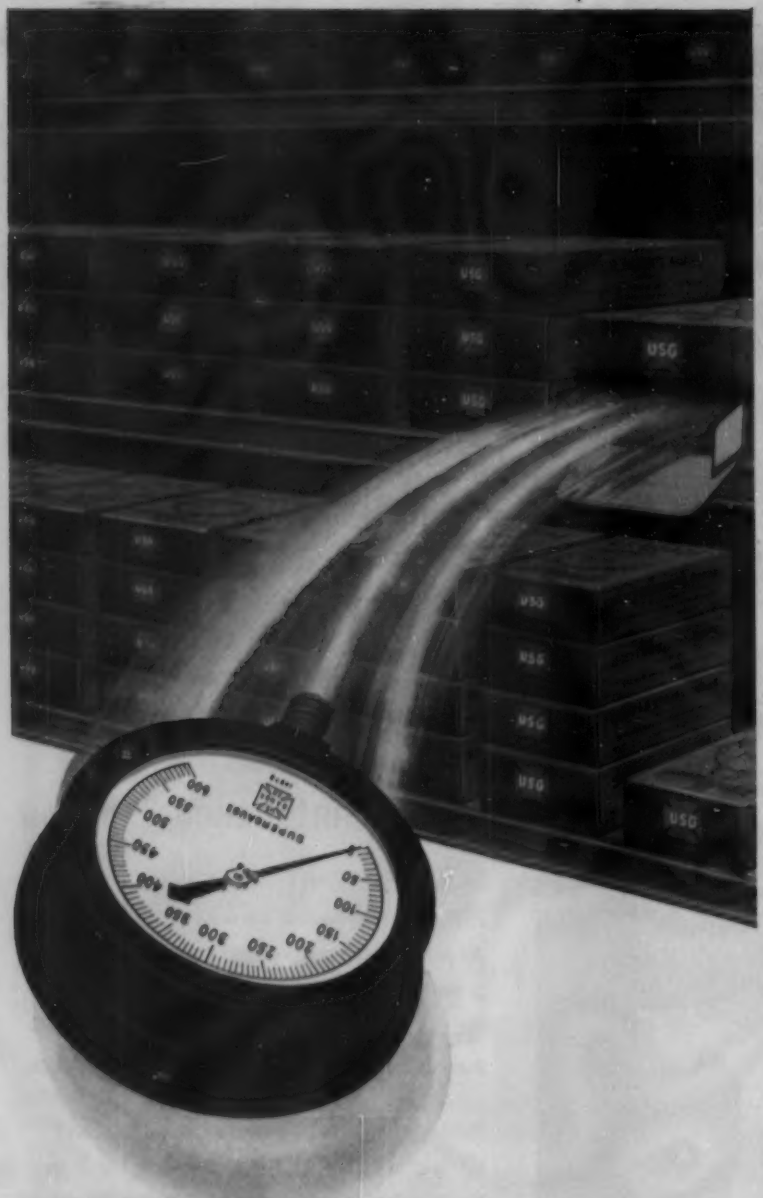


No. 11 for steam No. 71 for air No. 227 for water No. 33 for steam, air

MASONEILAN REGULATORS

Keep Pressure Under Control!

Order from your Mason-Neilan Distributor.
Use his experience.
Save work, save time.



MANY USG STOCK GAUGES ARE "SPECIALS" WITH OTHER MAKERS

For over 50 years USG has been designing and producing gauges for more original equipment manufacturers than any other instrument company in the world.

Many of USG's "special" designs have become standard stock items in the industry. Many others that are "standard stock" at USG require expensive special production with other instrument manufacturers.

To meet special gauge requirements economically, USG maintains the world's largest stock of gauge components to meet any pressure sensing and actuating need.

In addition to these huge stocks for special designs, USG inventories over 200,000 standard gauges in a variety of types, sizes and ranges for practically every industry application.

To assure higher quality gauges with enduring accuracy, USG maintains the most rigid quality control system in the instrument industry. This rigid inspection system is supported by a Standards Laboratory with masters measuring from low vacuums to super pressures.

USG's facilities are economically integrated for large volume, quality controlled production, assuring better gauges—with enduring accuracy—*in every competitive price class.*

Above, a portion of USG's Research Laboratory. Here constant testing of materials under customer operating conditions assures optimum efficiency and long gauge life.

From stock to you...

Fast!

In addition to the well stocked shelves of your USG Distributor, USG stocks over 200,000 gauges in a variety of types, sizes and ranges to meet every industry need.

Your USG Distributor has on his shelves, or can get for you fast, any quantity of gauges you want for any application. See your USG Distributor for all your gauge requirements.

UNITED STATES GAUGE *Gauge Headquarters*

FOR OVER 50 YEARS

United States Gauge, Division of American Machine and Metals, Inc., Sellersville, Penna.

This DATA may solve YOUR piping problem

● Here is the up-to-date story of Yoloy Continuous Weld Pipe—a remarkable low alloy steel whose nickel-copper content gives it unique ability to withstand corrosion, abrasion and shock. These outstanding advantages combined with high strength, ductility and weldability make Yoloy Pipe an excellent selection.

Proved by 18 years of satisfactory performance, Yoloy is highly recommended by users in such service as radiant heating, snow melting, gas line gathering, brine lines and other industrial piping.

This new folder presents the facts and figures on Yoloy's physical and chemical properties, with data on sizes now available and other information you'll need to select Yoloy Continuous Weld Pipe to meet your special requirements. Write for a copy today.

Youngstown

QUALITY
YOUNGSTOWN
SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

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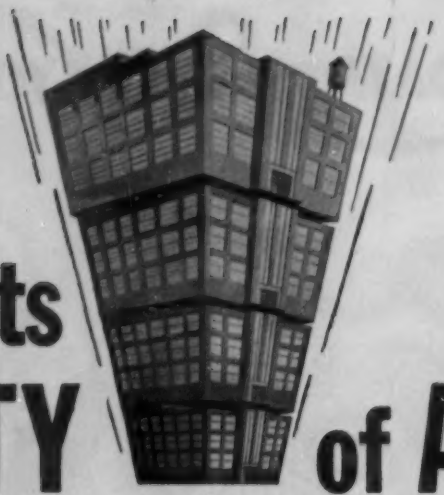
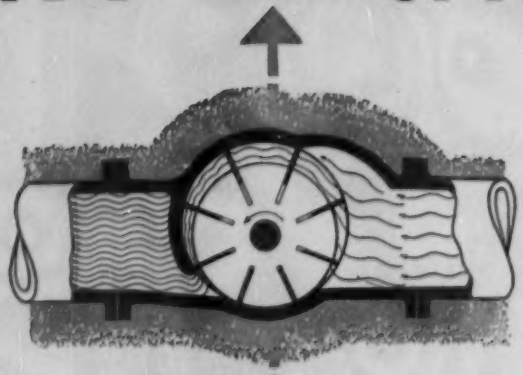
COLD FINISHED CARBON AND ALLOY BARS · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · WIRE · PIPE AND TUBULAR PRODUCTS · CONDUIT · RODS · SHEETS · PLATES · BARS · RAILROAD TRACK SPIKES

Growing Plants need PLENTY of AIR!





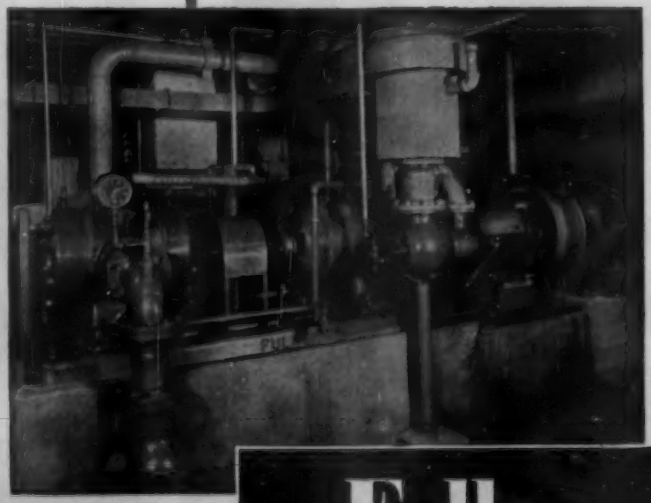
As abundantly demonstrated in thousands of successful installations, the simplest, most economical and most reliable source of compressed air for all pnuematic plant services is the Fuller vane-type Rotary Compressor.

This compressor has an irreducible number of moving parts—rotors, blades and bearings—and for this reason it is ideally adapted for continuous service in out-of-the-way locations without attention.

With direct-connected motor drive and operating with incredible lack of vibration, these compressors run for days on end without even being seen, much less inspected.

When you need such performance, it will pay you to specify Fuller Rotaries—for pressure up to 125 psig. and capacities to 3300 cfm.

Detailed information on design characteristics, and typical applications will be forwarded promptly on request.



FULLER COMPANY, Catasauqua, Pa.

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GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY

Chicago · San Francisco · Los Angeles · Seattle · Birmingham

Fuller

. . . . pioneers in harnessing AIR

THE SUN ALWAYS SHINES ON PEROLIN CUSTOMERS

USED THE WORLD OVER

on land and sea

50 YEARS OF PROGRESS have built a world-wide PEROLIN organization. PEROLIN PRODUCTS meet the maintenance needs of power plants on land and sea and they are the choice of engineers the world over. Whatever your problem, wherever you are, just call a PEROLIN representative and let him help you.

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Write today for free technical information on any of these guaranteed PEROLIN PRODUCTS:

Algae Preventive
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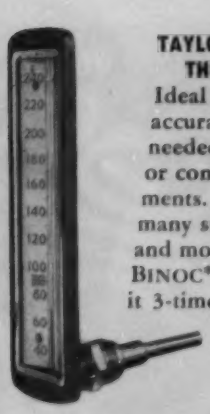
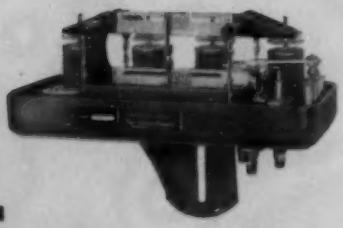
51 WAREHOUSES IN THE U. S., CANADA, AND FOREIGN COUNTRIES

A HALF-CENTURY OF EXPERIENCE THE WORLD OVER

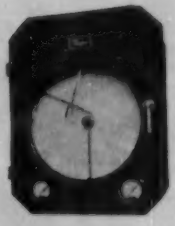
6 (count 'em) 6 Comforts for your Comptroller



TAYLOR INDUSTRIAL THERMOMETER
Ideal wherever an accurate check is needed on recording or controlling instruments. Available in many standard ranges and mounting angles. BINOC* tubing makes it 3-times-easier-to-read.



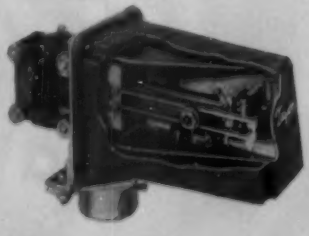
TRANSET* COMPUTING RELAY
A pneumatic, force-balance transmitter for adding, subtracting, averaging and ratioing. For intricate applications requiring close computing accuracy. Handles up to 3 separate pneumatic input pressures with .5% accuracy.



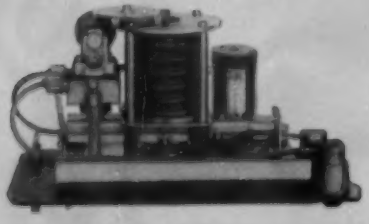
RECORDING FULSCOPE* CONTROLLER
For desuperheaters, or for any close, accurate control of temperature, pressure, flow or liquid level. Quickly adapted to operating requirements.

WHY? Because these Taylor instruments will help you increase operating efficiency and cut costs. That's enough to warm the heart of the coldest finance man. Of course, these are only a few of the complete line we can offer you for better measurement or control of temperature, pressure, flow or liquid level. Ask your Taylor Field Engineer! Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

NEW 6" DIAL INDICATOR
For temperature and pressure measurements. Has an all-new design movement for greater sensitivity on any type of measuring job. New case can be flush or face mounted, is fume and moisture proof. Big selection of standard ranges.



TAYLOR TRANSAIRE* DIFFERENTIAL PRESSURE TRANSMITTER
A rugged, dependable and accurate instrument designed to measure flow, liquid level or specific gravity. Taylor's latest addition to TRANSET System of transmitters, receivers and controllers.



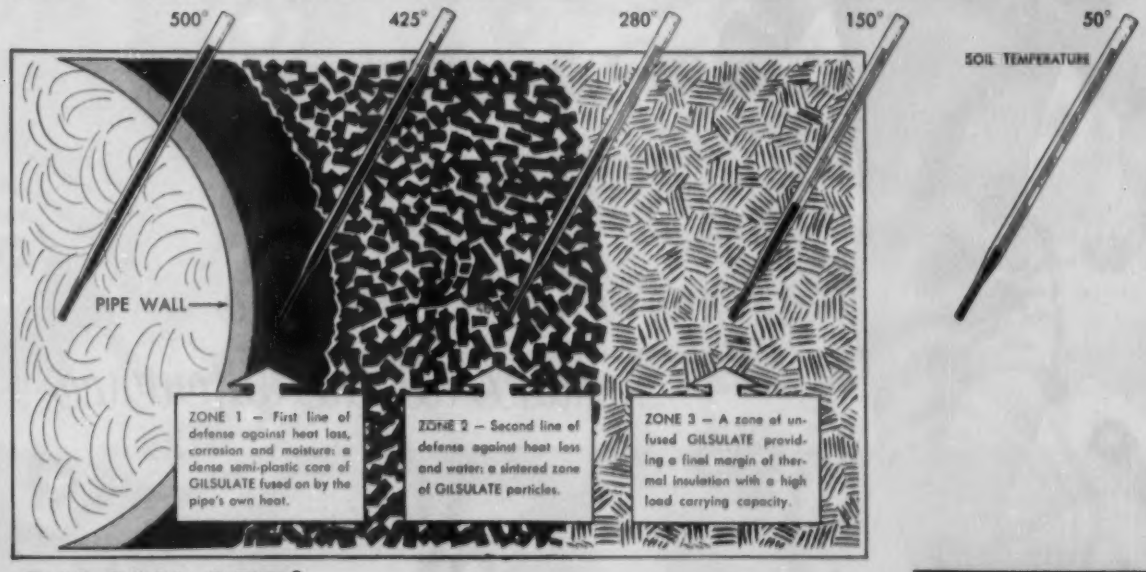
TAYLOR TRANSAIRE TEMPERATURE TRANSMITTER
Compact and super-responsive. Designed to measure and transmit smallest temperature changes up to 1,000 feet with great accuracy. Provides dynamic accuracy, thanks to derivative action in the measuring circuit. Similar instruments for highly accurate pressure measurement.

*Reg. U.S. Pat. Off

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

Lowest Cost

PER INSTALLED LINEAR FOOT OF ANY HOT UNDERGROUND PIPE INSULATION


500°
425°
280°
150°
50°
SOIL TEMPERATURE
PIPE WALL
ZONE 1 — First line of defense against heat loss, corrosion and moisture: a dense semi-plastic core of GILSULATE fused on by the pipe's own heat.
ZONE 2 — Second line of defense against heat loss and water: a sintered zone of GILSULATE particles.
ZONE 3 — A zone of unfused GILSULATE providing a final margin of thermal insulation with a high load carrying capacity.

GILSULATE®... the triple-zone insulation that fuses itself into lifetime protection for hot underground pipes. Water-proof, corrosion-proof, root-proof, acid/alkali-proof.

Compare your present insulation methods with Gilsulation®:

1. Pour Gilsulate granules out of the bag onto the pipe; tamp it down.
2. Backfill: *the job is insulated!*

Gilsulate—nature's own insulation—is a unique, solidified hydrocarbon that virtually installs itself. Normal pipe-heat (up to 520°F) does the rest—fuses the Gilsulate to the pipe in hours, forming a massive circular solidified sheath.

Gilsulate costs less installed per linear foot *than any other underground pipe insulation*... it's easiest to use... and has been tested in scores of the country's largest and most important installations.

Some additional Gilsulate advantages:

- *3 grades available*—220° to 520° F
- *needs no sleeves* or mechanical sheaths
- *requires no mixing* or special handling
- *can't be punctured*—leave rocks in backfill
- *pipe expands and contracts* within Gilsulate structure
- *proved in actual use* in hundreds of new construction and replacement installations

Send coupon for descriptive literature.

AMERICAN GILSONITE COMPANY
SALT LAKE CITY, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of California

No skills necessary—simply pour Gilsulate out of 100 pound bags, tamp and backfill. Can be used under any and all conditions—no matter how many pipes, whatever the space.

GILSULATE®

THE TRIPLE-ZONE INSULATION
FOR LIFETIME PROTECTION
OF HOT UNDERGROUND PIPES.

American Gilsonite Company
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Please send me descriptive literature on Gilsulate.

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3:59.4 or 4:01.4

There's enough difference To make all the difference

A difference of only 2 seconds . . . but it made sports history on May 6, 1954, when the first under-four-minute mile was run in Oxford, England.

The differences in quality and performance that Scovill builds into its Heat Exchanger Tube, while they also may seem small, can make a *big* difference in improving your operating record. Scovill Phosphorized Admiralty Heat Exchanger Tube, for example, begins its long service life with an added advantage. It is initially hot-extruded from billets *continuous-cast* by Scovill's pioneer process. This means sounder metal — smooth, dense, free from pits or porosity. It means new uniformity of chemical composition, with optimum and uniformly distributed phosphorus content.

The next time you have a new installation or a re-tubing job, let us show you how these differences in Scovill Heat Exchanger Tube work for you.

Scovill Manufacturing Company, Mill Products Division, 99 Mill Street, Waterbury 20, Connecticut. Phone PLaza 4-1171.

SCOVILL **HEAT EXCHANGER TUBE**

Phosphorized Admiralty • Admiralty • Arsenical Admiralty • Muntz Metal • Naval Brass • Red Brass, 85% • Deoxidized Copper
Arsenical Copper • Copper Nickel, 10% & 20% • Cupro Nickel, 30% • Aluminum Brass • Aluminum Bronze, 5% • Duplex Tube

190C88

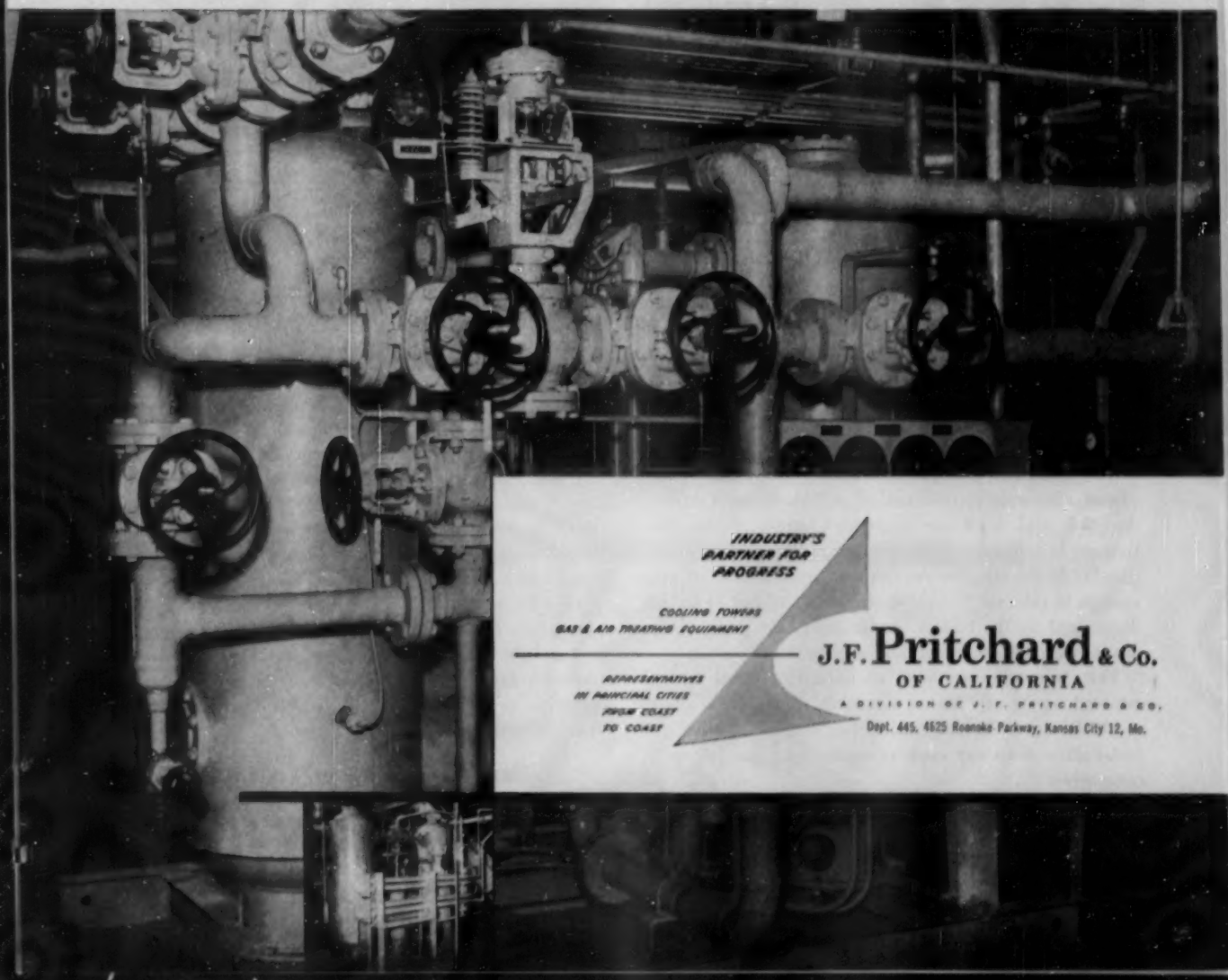
PACIFIC GAS & ELECTRIC

USES A HYDRYER TO DRY INSTRUMENT AIR!

Pacific Gas & Electric, San Francisco, Calif., uses a Pritchard HYDRYER® to dry instrument air at their Contra Costa Steam Plant, Antioch, Calif. The HYDRYER receives air from instrument air receivers and discharges into a single header supplying the plant instrument and control air system.

This packaged, Pritchard unit continuously delivers air with a dew point temperature not in excess of —20°F. capacity, 420 CFM at standard conditions; pressure 100 psig; temperature, 80°F.

The many repeat orders on HYDRYERS prove their performance record in the drying of instrument air and other gases in many industries. Find out more about these dependable, packaged dehydration units by writing for bulletin 16.0.081 today!



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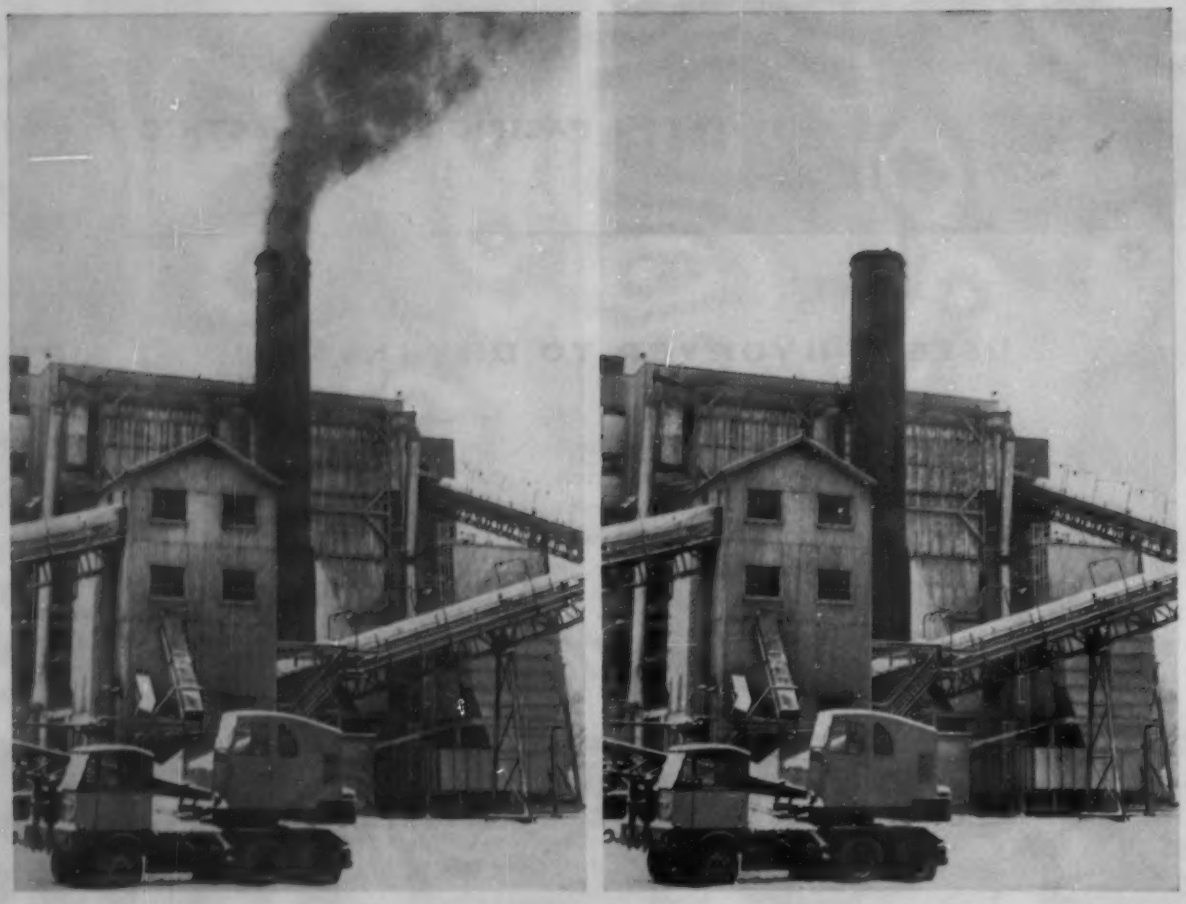
COOLING TOWERS
GAS & AIR TREATING EQUIPMENT

REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

J.F. Pritchard & Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 445, 4525 Roanoke Parkway, Kansas City 12, Mo.



Fly Ash Problem Solved By Central Station

This Pennsylvania utility felt that as long as you can *see* dirty stack discharge, you have a problem. To solve it, they decided to insist on fly ash collection equipment with very high efficiency.

The electrical precipitators they chose, which were placed after existing mechanical collectors, are Cottrells, designed and built by Research-Cottrell. Their effectiveness is demonstrated in the above unretouched photographs. At the left, the precipitators were turned off long enough to take the picture showing the volume of fly ash discharged by the boilers. At the right, the precipitators are turned back on. Stack discharge is visually clean.

This is another example of industry's trend toward establishing its own higher standards for nuisance abatement. Research-Cottrell, which has made more fly ash installations than any other company, cites the following comparison:

In the period from 1923 to 1939 only 11% of its power plant customers specified fly ash collection efficiency of 95 to 98%. In recent years, that 11% has risen to fully 90%.

One reason, of course, is the generally increasing emphasis on community relations. Another factor is that far-sighted companies are anticipating stricter smoke regulations. They are anxious to install equipment that will end their smoke problems now and also prevent such problems from occurring in the future.

Still another factor is this. In recent years, with modern coal pulverization and advanced boiler design, there has been an increase in the fineness of fly ash particles. This calls for the most efficient equipment available.

Read—in Bulletins FA and MI—about Cottrell equipment and the Research-Cottrell's MI Rapper. This device eliminates rapping puffs and enables the precipitator to maintain, continuously, its high collection efficiency. Write for your copies today.

RC-169

RESEARCH-COTTRELL, INC.

A WHOLLY OWNED SUBSIDIARY OF RESEARCH CORPORATION

Main Office and Plant: Bound Brook, N. J.

405 Lexington Ave., New York 17, N. Y. • Grant Building, Pittsburgh 19, Pa.

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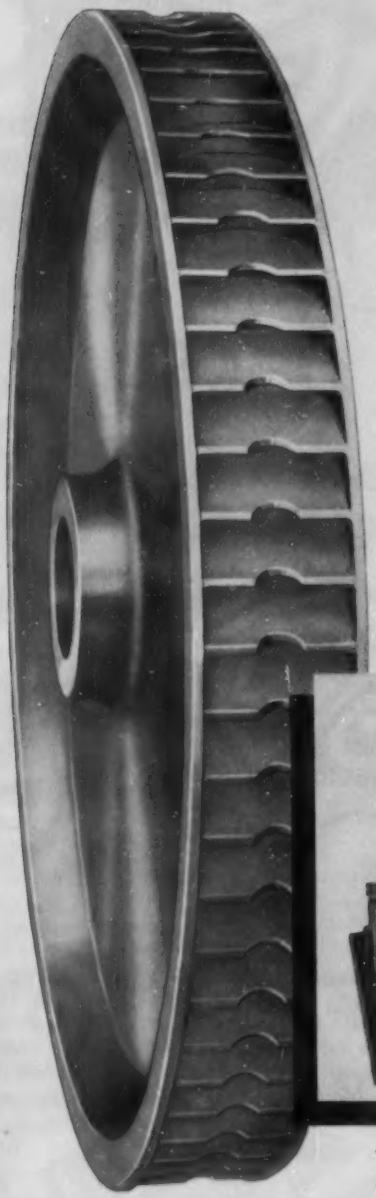
TERRY SOLID-WHEEL *SIMPLICITY* MEANS *SUSTAINED* HP



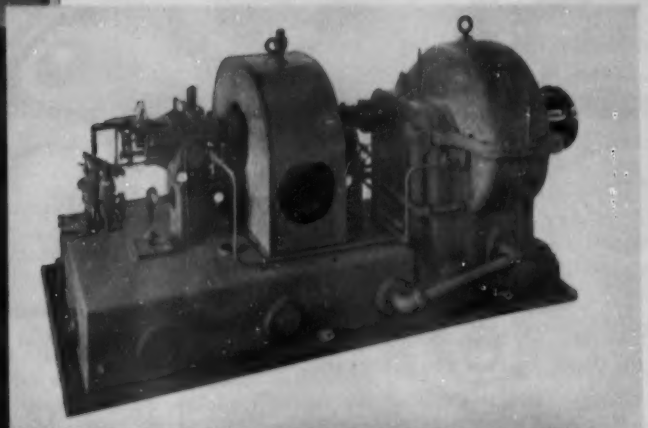
A Terry solid-wheel turbine is simplicity itself. Particularly the rotor. This is a single forging of special composition steel. And, unlike a built-up wheel, has no separate parts to loosen or work out.

Blade wear which might occur after years and years of usage is of little consequence, because the power-producing action of the steam takes place on the curved surfaces at the backs of the buckets. Thus wear does not materially affect horsepower or efficiency.

The blades can't foul. There is a one inch clearance on either side of the wheel and, in addition, the blades are double rim protected. There is no need for close axial blade clearance, because the steam enters the buckets at right angles to the shaft.

Perhaps you, too, can profit from Terry solid-wheel stamina. Bulletin S-116 gives complete details. Send for a copy today.

TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONNECTICUT



This Terry solid-wheel turbo-geared unit is rated 600 hp, 4000/650 rpm for 820 psi, 825°F steam with 275 psi back pressure.

TERRY

TT-1201

How COOPER-BESSEMER Power digs out Al_2O_3. $2SiO_2$. $2H_2O$... and piles up economy

This heavy-duty Cooper-Bessemer powered Bucyrus-Erie walking dragline, owned by Southern Clays, Inc., is used to strip overburden in the clay area running northeast from Macon, Georgia.

Al_2O_3. $2SiO_2$. $2H_2O$ . . . chemical symbol for kaolin . . . is a special kind of clay required by the paper, ceramic and rubber industries.

In Georgia, where 80% of the nation's kaolin supply is found, a 550 hp Cooper-Bessemer diesel supplies digging as well as walking power for this big Bucyrus-Erie 7-W dragline used to strip overburden from kaolin.

Stripping to a depth of 100 feet takes a lot of "drag," and an equal amount of Diesel stamina and flexibility. It means hour after hour of no-load-too-full load operation at nearly constant governor-controlled speed.

With Cooper-Bessemer Diesel power, there's not only top availability, but instant response and smooth operation at any load . . . on the most rugged of dragline jobs. It adds up to maximum production at minimum cost.

If your plans call for powering or repowering — mobile, stationary, marine — contact our nearest office for complete facts on Cooper-Bessemer advanced, money-saving features.

MOUNT VERNON, OHIO

COOPER-BESSEMER

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DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

How to Select an Economical Temperature Regulator

First of all, what does economy mean where temperature regulators are concerned? In some industries it means improvement of product or reduction of spoilage through closer control of process temperatures. In others, it means the paring down of operating expense. The price of the regulator itself is a relatively small factor.

Today's buyers are shopping for:

1. Accuracy of control — not only when the regulator is new, but throughout its service life
2. Dependability — to prevent loss of production time
3. Minimum installation and maintenance cost

Here are a few tips on what to look for when you're installing a new or replacing an old temperature regulator —

Packless construction . . . and for this reason: A diaphragm operated, packless regulator minimizes friction. There are no closely fitted parts to stick or bind because of uneven expansion or collection of foreign matter. Also, there's less maintenance, since no repacking is ever required.

A guarantee against wire drawing of the seats and discs. Insist on it. This guarantee in combination with single seat design assures you of tight shutoff; you avoid expensive steam losses as well as loss of product in a process application.

Broad control range. In a standard regulator you should expect a control range of 100 F. And make sure the unit you select has a vapor tension thermostat that can take over-temperatures of at least 100 F.

Easy maintenance. Why ask for grief? Your temperature regulator should be basically simple in design so that it can be serviced by average plant personnel. All parts should be readily accessible for testing and cleaning.

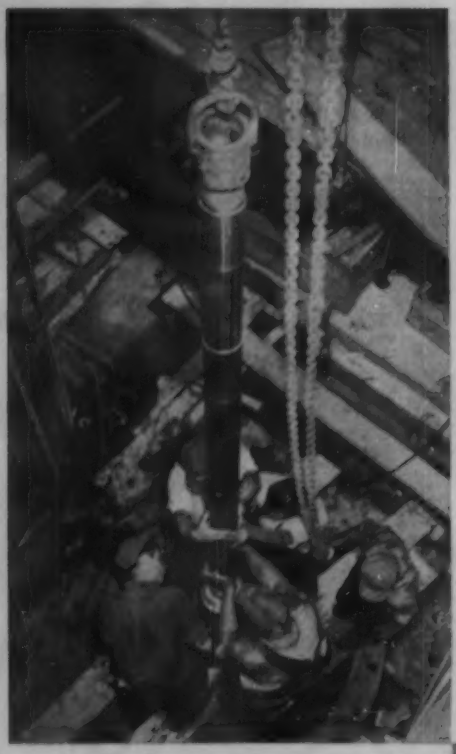
Double duty. There's no point in buying a separate pressure regulator when you can select a temperature regulator that combines both temperature and pressure control within the same unit.

Self-operating. Make sure you get a regulator that operates on its own initial pressure. By doing so, you avoid the purchasing and maintenance of an air compressor plus air piping, and you're sure of uninterrupted operation during electric power failures.

• • • •

All of these points are important to you when it comes to selecting an economical temperature regulator. Perhaps you didn't realize you could expect so much. And perhaps you didn't realize that Spence Temperature Regulators offer all these features and more. May we send you our Bulletin T500 containing further details? **SE 188**

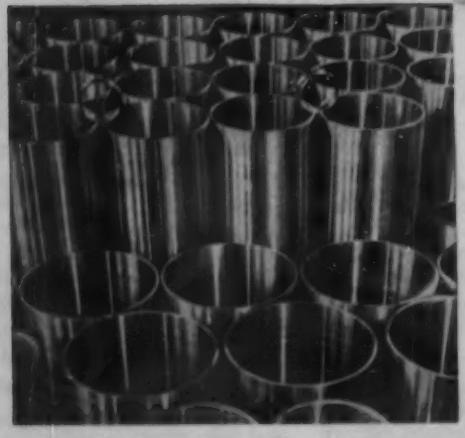
SPENCE ENGINEERING COMPANY, INC.
Walden, New York



"K" Monel pump shaft being installed by utility company to avoid costly periodic breakdowns previously encountered with steel shafts in pumps circulating polluted and corrosive salt water. "K" Monel can be heat treated for great strength and hardness.

Monel pump valve for reciprocating circulating water pump withstands severe erosion-corrosion. Monel's tensile strength and resistance to fatigue are as high or higher than those of structural steel.

Ripe old age for pump parts



Cast "S" Monel liners reduce wear on pistons where gritty corrosive liquids are found. The resistance of "S" Monel to cavitation-erosion makes it ideal also for impellers in centrifugal pumps. Users have reported "S" Monel impellers lasting 3 to 30 times longer than other materials.

Some pumps are built to last; others aren't. But you can increase the service life of your pumps if you choose pump parts with the right kind of "life insurance." That means parts made of materials with exceptional resistance to corrosion, fatigue, erosion and wear; parts of high strength and hardness.

Outstanding among these more durable materials are the Inco Nickel Alloys like Monel®, "K"® Monel and "S"® Monel. A majority of pump users have found that with these alloys, pump parts last much longer.

The next time *you* have to repair one of your pumps, ask your pump manufacturer to duplicate the part in one of the Inco Nickel Alloys. And write Inco for the helpful booklet, *How to Get Longer Service from your Pumps.*

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

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Henry Vogt Machine Co., Louisville, Ky.

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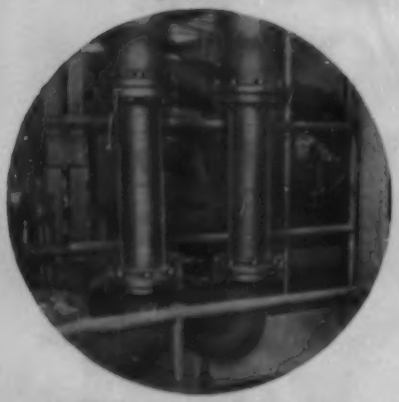
Superheaters of 300,000 kw Steam Generator. Safety blow-off valves, exhausting to atmosphere, have Penflex expansion joints.

PENFLEX "give-and-take" prevents blow-outs on blow-offs



Penflex Galvanized Steel Interlocked Tubing (8" I.D.), flanged at both ends. Installed as expansion joints on safety blow-off valves, they take up to 850 psi steam pressure at 900°F.

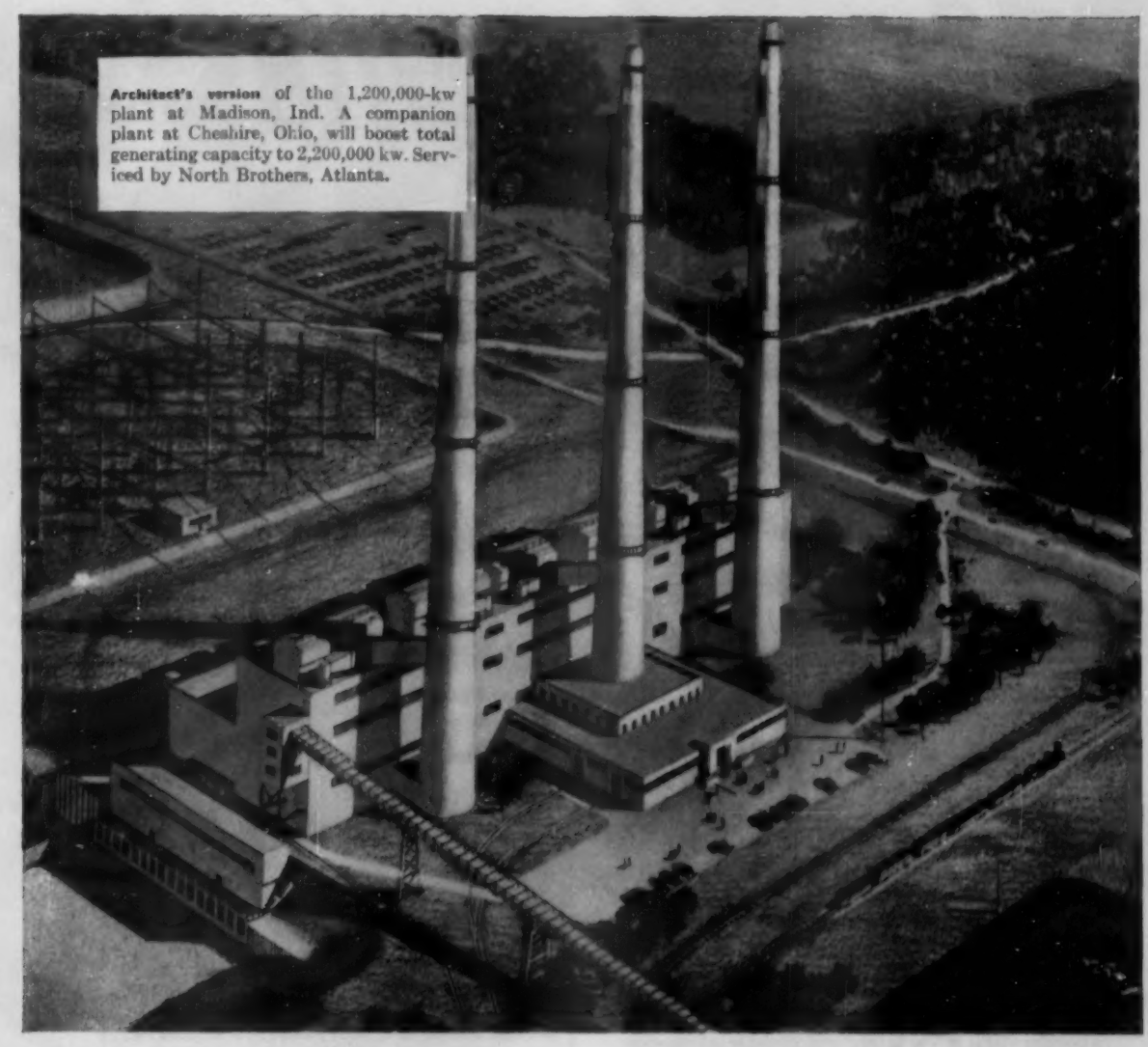
Power plant applications like this one can't use less than Penflex Metal Tubing offers in flexibility, strength, and tightness. When safety valves go, expansion joints must hold. Penflex joints *do*. That's because they can give with the pressure and take it, too.

Thermal expansion at 900°F. . . . pressures up to 850 psi . . . impact and pipe movement under these strains—all are safely handled by Penflex. Forty-two complete units in this big power plant are protected from blow-outs by Penflex.

There are hundreds of other applications in the steam and diesel power fields for Penflex Interlocked Tubing and Penflexweld High-pressure Tubing. Call in the Penflex engineer to help you on your own particular problems. In the meantime, write for "Flexineering," your guide in buying and using Penflex Flexible Metal Tubing. There is no charge or obligation.

Pennsylvania Flexible Metallic Tubing Company, Inc., 7237 Powers Lane, Phila. 42, Pa.
Branch Sales Offices: **Boston • New York • Chicago • Houston • Cleveland • Los Angeles and Distributors in Principal Cities**

COMBINES FLEXIBILITY WITH DURABILITY



Architect's version of the 1,200,000-kw plant at Madison, Ind. A companion plant at Cheshire, Ohio, will boost total generating capacity to 2,200,000 kw. Serviced by North Brothers, Atlanta.

PICKED FOR TOP ELECTRIC PROJECT

Fiberglas and Kaylo selected for $4,000,000 power insulation contract

Fiberglas* and Kaylo® insulations will contribute importantly to the efficient, economical functioning of two tremendous steam-electric power plants being built by the Ohio Valley Electric Corporation. OVEC was organized by 15 private electric utilities to provide the full electric requirements of the Atomic Energy Commission's new diffusion plant near Portsmouth, Ohio—power which will come from the 1,200,000-kw Clifty Creek Plant at Madison, Ind., and the 1,000,000-kw Kyger Creek Plant at Cheshire, Ohio. This $4-million insulation contract is thought to be the largest of its kind in electric utility industry history.

Fiberglas and Kaylo are outstanding in thermal efficiency—exceptionally strong, moisture-resistant, dimensionally stable, light in weight, easy to apply. They can even be re-used after removal for inspection. Together, they offer the most complete and versatile line of plant insulations available, ranging from lowest sub-zero to 1200° F. (Kaylo is now distributed by Owens-Corning Fiberglas Corp. Available in quantity.)

For full technical data, refer to Sweet's File, Chemical Engineering Catalog or Refinery Catalog—or write direct to Owens-Corning Fiberglas Corporation, Dept. 186-D, Toledo 1, Ohio.

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*T. M. Reg. Owens-Corning Fiberglas Corporation
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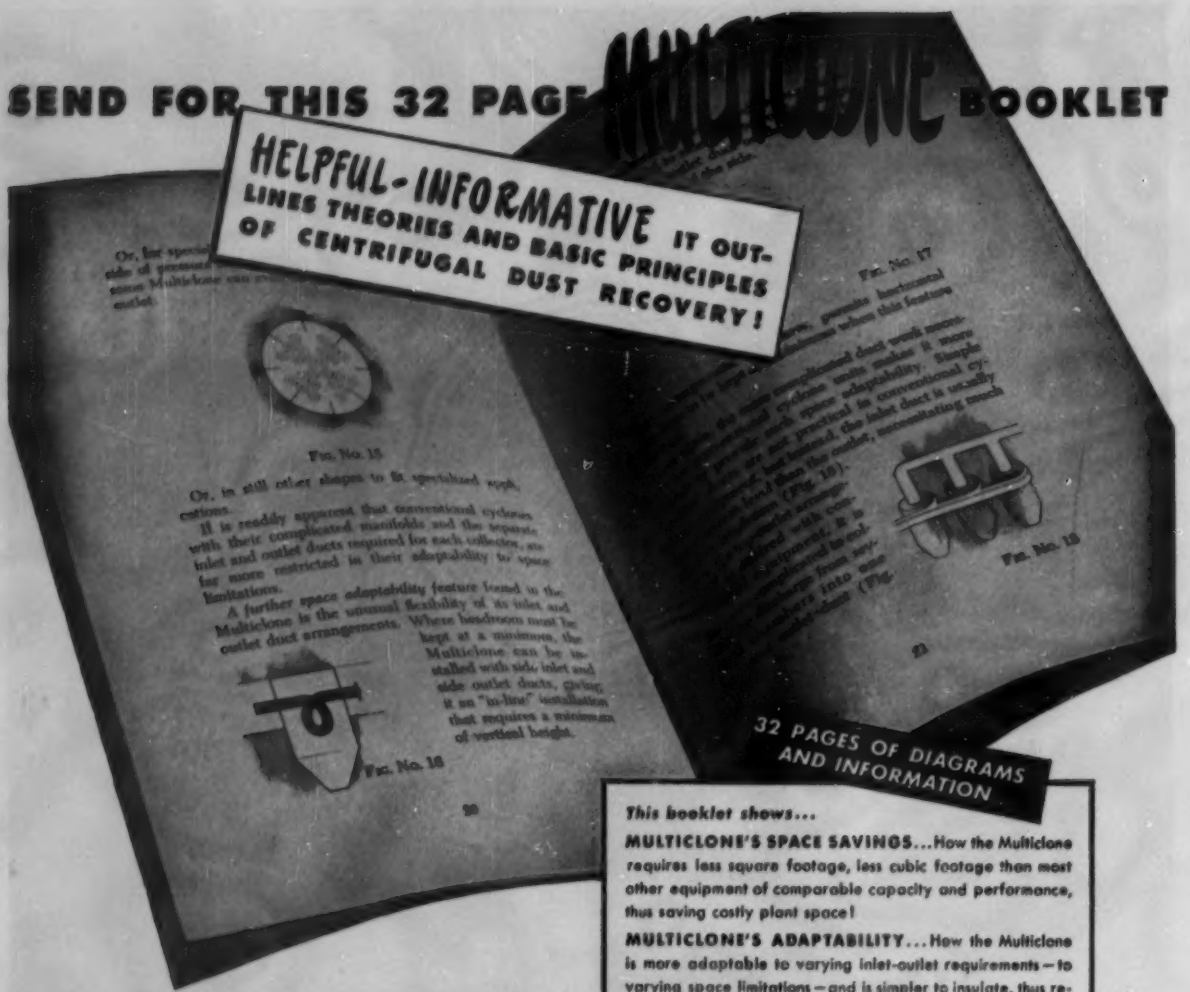
SEND FOR THIS 32 PAGE MULTICLONE BOOKLET


HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!
Fig. No. 15
Fig. No. 16
Fig. No. 17
Fig. No. 18
32 PAGES OF DIAGRAMS AND INFORMATION

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

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This booklet shows...

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MULTICLONE'S ADAPTABILITY...How the Multiclone is more adaptable to varying inlet-outlet requirements—to varying space limitations—and is simpler to insulate, thus reducing installation costs!

MULTICLONE'S EFFICIENCY...How Multiclone's multiple *small diameter* tubes, made possible by its exclusive vane design, give higher centrifugal forces and more complete cleansing of *all* suspended particles—even small ones of 10 microns and less!

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Make sure that a copy of this helpful booklet is in your reference files by sending for your copy now!

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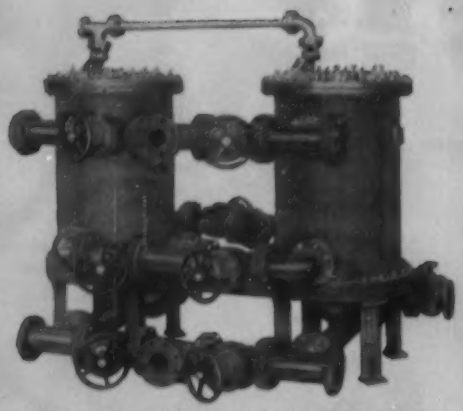
here's Proof Positive



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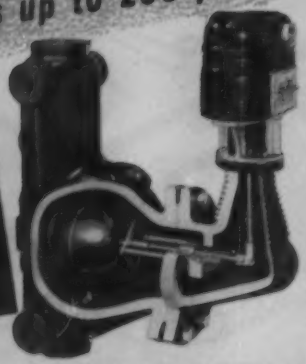

It's a float-operated, twin switch control. Use it to start and stop boiler feed pump; cut-off burner in event of low water; and for many other liquid level control jobs. Introduces magnetic repulsion switching as one of several major innovations. Underwriters' approved.

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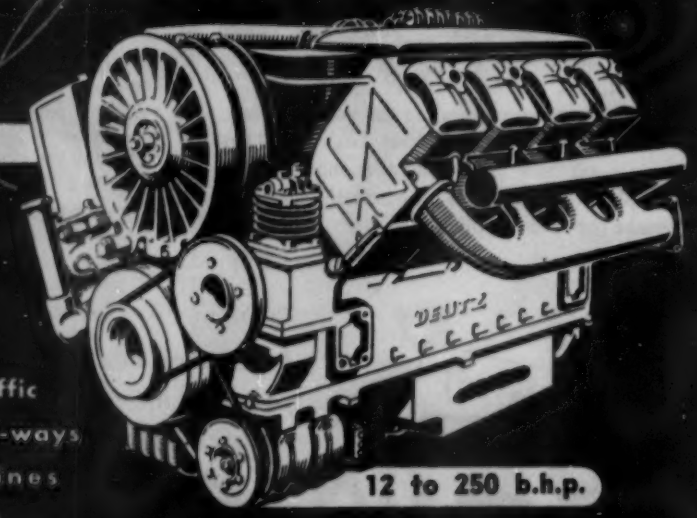

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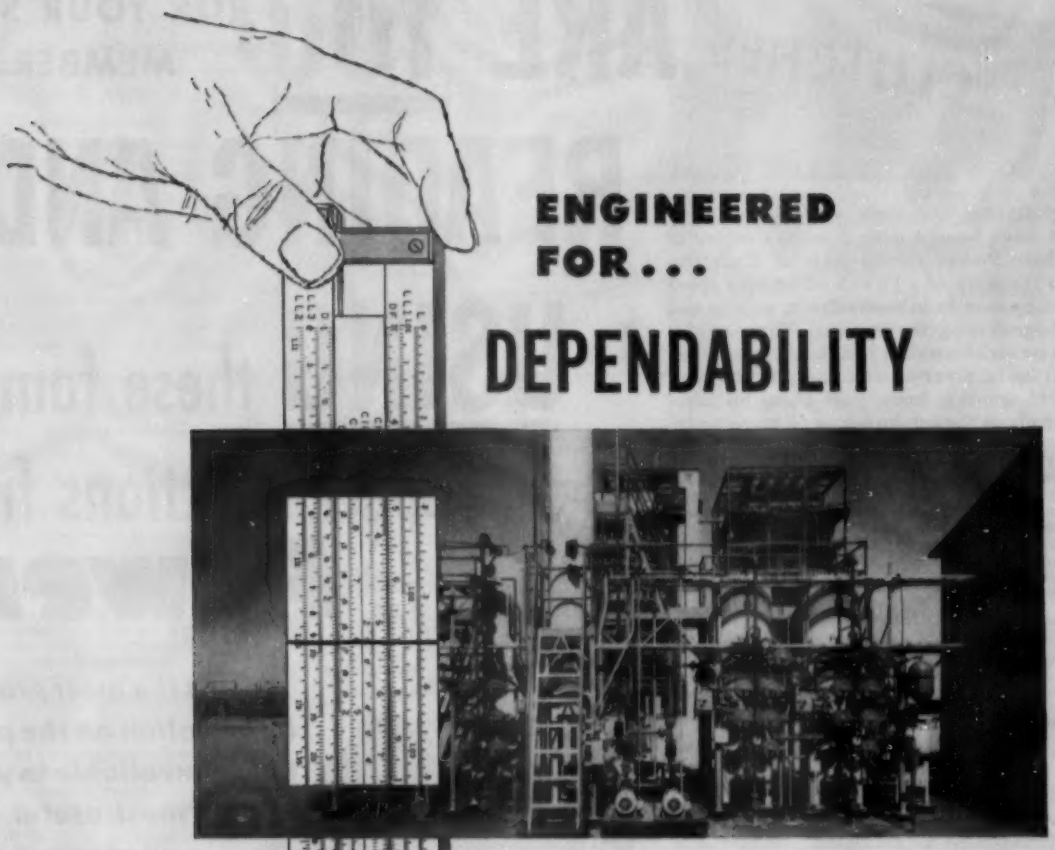

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450	440	Whse.		514
450	440	Whse.		720
300	2300/660	G. E.		720
300	440	G. E.	(hoist)	600
300	2300	G. E.		300
300	440	Whse.		3600
250	440/220	Whse.		600
250	550/440	G. E.		1200
200	440/220	Whse.		514
150(2)	440/220	G. E.		720
150	2300/440	G. E.		600
125	440/220	G. E.	(hoist)	600
125	440/220	G. E.		900
125	550/440	G. E.		1200
125	2300	G. E.		600

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375	440/220	Whse.	G	900
250	440/220	EL Mashy.	Syn.	1200
300	2300/400	G. E.	TS	720
300	2300/440	G. E.	TS	1200
250	2300/440	G. E.	TS	720
250	440/220	Whse.	HR	277
250	440/220	G. E.	ATI	600
125	440/220	Whse.	HR	600

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H.P.	Volts	Make	Type	Speed
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400	2300	G. E.		450
400	2300/600	Whse	CS	720
300	2300	L. Allis	PH	1800
250(3)	2300/440	G. E.	KT	1200
200	440	G. E.	JK	720
200	440/220	G. E.	KT	1800
200	2300/440	G. E.	JK	900
200	2300	G. E.	KT	1800
150	440/220	Whse.	CS	900
150	2300	Al. Chal.	AR	1800
150	220	Whse.	CS	1200
150	440/220	G. E.	JK	450
150	440/220	G. E.	KT	720
150	2300/440		KT	600

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H.P.	Volts	Make	Type	Speed
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150	230	Whse.	SK	1764
100	230	Whse.	SK	490/1300
90	230	G. E.	CD	1760

MOTOR GENERATOR SETS

KW	Make	Input V., AC	Motor Type	Output V., DC
300	Whse.	2200	Syn.	250
175	G. E.	550/440	Syn.	230
135	G. E.	440/220	Syn.	250/125
100	Al. Ch.	220/440	eq. cs.	240/120
140	Whse.	440/220	eq. cs.	125
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50 KVA Lefkot Gas 3/60/220
40 KVA Chrysler Diesel 3/60/220
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1—75 KW Murphy 3/60/440
1—10 KW Winchargar 1/60/110-220 Gasoline

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2—250 HP Keeler Type CP-160 Lb.—1948
1—250 HP Ames Package Type (1948) 150 psi
1—30 HP Clayton New
5—18 HP Red-Line New Horizontal Oil Fired 150 lbs. W.P.

ELECTRIC MOTORS

QU.	HP	Make	Type	Volts	Speed
1	500	West.	CS	4600/2300	514
1	450	A.C.	ANY	2300	600
1	400	West.	CW	440	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT15	2300	400
2	200	West.	CW	2300	1800
1	200	G.E.	I.M.	440	514
1	150	G.E.	I.M.	440	600
1	150	G.E.	K T	440	600
1	125	West.	Syn. 3 brg.	550	600
1	100	Al. Ch.	Sl. Rg.	2200	900
1	100	West.	CS	440	1200
1	100	West.	CW	440	900
1	100	G.E.	I.K.	2200	1200
1	100	G.E.	Dynam.	230	1050/3500
1	50	G.E.	M T	440	1200

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1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—75 KW G.E. Non-Cond. D.C. 125 volt.

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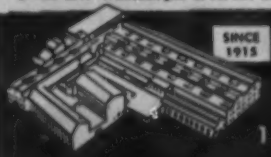
2—1300 cfm IR-PRE-2 3/60/2300—100 psi
1—978 CFM Sullivan 13x13x8. 45 psi.
1—670 CFM Chi. OCE Syn Mtr. Dr. 3/60/2300
1—368 CFM Chi. NSB, 12x10, 100 psi.
1—371 CFM Schramm 7¼x5x4, 100 psi
1—173 CFM Chicago NSB 100 psi

OISC TRANSFORMERS

Qu.	KVA	Make	Pri. V.	Sec. V.	Phase
3	2000	G.E.	13200	230/460	1
3	1000	GE	12200	2300	1
1	1150	West.	4160	440	3
1	750	O'Brien New	13200	480	3
3	667	Al. Ch.	33000	2300	1
3	500	Wagner	2300/2400/4160Y		1
2	500	West. Dry	33000	2300	1
3	500	West.	22000	460	1
1	500	Gregory	4160	440	3
3	400	GE	2400	460	1
3	333	West. Dry	2400	480	1
3	333	Pitts.	33000	2300	1
3	333	G.E.	13800	240/480	1
3	250	Al. Ch.	13,200	115/230	1
3	167	G. E.	12000	2400	1
2	150	G.E.	12200	2300/4000Y	1
3	150	West	2300	230/115	1
3	150	Dry	2300/4160	230/460	1
3	100	G.E.	13200	120/240	1
3	100	Dry	2300/4160	230/460	1
3	100	West.	4160	240/480	1
8	85	West.	4160	120/240	1

"Everything from a Pulley to a Powerhouse"



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There's more than 40% to 60% SAVINGS on

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Each Schoonmaker-sold Diesel Engine Unit is fully RE-MANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

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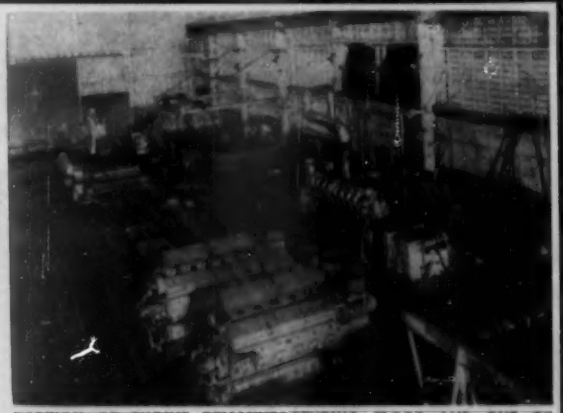
EDDYSTONE, PENNA. AND SAUSALITO (S.F.), CALIFORNIA



PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1180	Worthington	SEH-8	1685	360
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
1000	General Motors	16-567B	1440	720
750	General Motors	12-567	1080	720
700	Worthington	EE-8	1000	327
675	Fairbanks Morse	38D	960	720
*500	Alco	6-12½x13T	750	600
500	General Motors	8-567	720	720
*350	Baldwin	VO-6	510	450
320	Superior	60-S-6	460	450
*320	Enterprise	DSG-6	460	450
300	Fairbanks Morse	32E14	450	300
300	General Motors	8-268A	450	1200
200	General Motors	8-268A	350	900
*160	Buckeye	80	240	600
148	Fairbanks Morse	32E14	225	300
100	General Motors	3-268A	150	1200
60	General Motors	6-71	90	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED
*—indicates NEW unit

ONE YEAR GUARANTEE!

SAVE 50 TO 80% ON THE EQUIPMENT YOU NEED!

with CHICAGO ELECTRIC GUARANTEED "REBUILTS"

WIRE WRITE OR PHONE CAnal 6-2900

MOTOR GENERATOR SETS

KW	Make	A.C.	D.C.
1000	G.E.	13200	600
500	Westg.	4600	250
400	G.E.	2300	270
400	Al.-Ch.	2300	130/240
250	Westg.	2300	125/250
200	G.E.	2300	250/275
200	Westg.	4160/2300	275
200	Ridgeway	2300	250
170	G.E.	440	125
150	G.E.	2300	125/250
150	Al.-Ch.	2300	275
150	Westg.	2300	1250/250
150	G.E.	440	275
100	G.E.	2300	250
100	Westg.	440	125
100	Elec. Mch.	440	125
100	G.E.	440	125
100	G.E.	440	90
75	G.E.	440	125
50	Reliance	440	250
50	Ideal	2300	250
50	Westg.	240	125

SYNCHRONOUS MOTORS

3 phase, 60 cycle, 220 or 440 volt
(*2300 volts or higher)

HP	Make	Type	Power Factor	Speed
1420	*Westg.		.7	900
750	*Westg.		1.0	900
710	*G.E.	ATI	1.0	720
600	*G.E.	TS-7640	1.0	900
560	*G.E.	TS-7697	1.0	514
400	*Westg.	H	.8	1800
400	West.	HG	1.0	900
300	G.E.	ATI	.8	720
300	*Ideal	SMM	.8	257
300	G.E.	ATI	.8	1200
250	G.E.	ATI	.8	900
250	G.E. (New)	TS-674Y	.8 (3 brg)	720
225	G.E.	TS-6244	1.0	300
225	El. Mch.		1.0	360
200	F. Morse	TJC-285	.8	720
190	El. Mch.		1.0	720
150	F. Morse	TJC-285	.8	720
150	G.E.	ATI	.8	720
150	*El. Mch.		.8	1200
150	Westg.	HR	1.0	300
125	*G.E.	TS-7641	1.0	514
125	*G.E.	TS-6214	1.0	277
125	*El. Mch.		1.0	900
115	El. Mch.		1.0	240
110	G.E.	TS	.9	514
100	Westg.		1.0	900
100	Ideal	SNS	1.0	900
15	Ideal	FRS	1.0	1800
15	Century	ARC-265	1.0	1200
7½	Ideal	FRS	.8	1800

SQUIRREL CAGE MOTORS

3 phase, 60 cycle, 220 or 440 volts.
(*2300 volts or higher)

HP	Make	Type	Speed
1250	*Al.-Ch.	ANW	3600
1250	*Al.-Ch.	ANW	1200
800	*Westg.	CR	3600
800	*Westg.	CR-1485	1800
700	*Westg.	CR	1200
700	Al.-Ch.	AN	900
500	*Al.-Ch.	6516-SW	1800
500	G.E.	KT-424	450
400	G.E.	KP-520	3600
400	G.E.	KT-424	360
350	Ideal	A	1800
300	*G.E.	K-6311Y	1200
300	G.E.	K-6358 TEFC	720
250	G.E.	KT-5508	1800
250	Westg.	CS8758	1800
250	*L.-Allis	OGK-148	720
250	*G.E.	IK	600
250	G.E.	IK-17A	600
250	West.	CR-14	514
200	*G.E.	FT-540Y	3600
225	*G.E.	IK-13B	1800
200	*Cr. Wh.	SC	900
200	Al.-Ch.	ARWWT	600
200	*Westg.	CR	600
200	Al.-Ch.	AN	514
150	G.E.	IE-13B	1200
150	Westg.	CS-7725	1200
150	*Westg.	CS-81205 TEFC	1200
150	Westg.	CS-876C TEFC	900
150	Wagner	RP2-31V	900
150	*Westg.	CR	600
125	*Westg.	CS-771 Spof.	1800

D. C. MOTORS — 230 Volt

HP	Make	Type	Speed
250	Westg.	SK-256	455/609
200	Westg.	SK-201	650
200	Cr. Wh.	CM	560
175	G.E.	RLC	750
100	G.E.	MPC	400/800
100	G.E.	RC-34	2560
100	G.E.	RC-19	575
100/150	G.E.	MCF	330/1000
75	G.E.	RCFP-34	1750
75/25	Westg.	SK-151	400/1600
50/120	G.E.	MCF	350/1600
50	Cr. Wh.	CMC	700/1150
50	G.E.	DLC	650
25	Westg.	SK-150	350/1000
30	Cr. Wh.	CCM-504	450
30/40	G.E.	CD-110	500/1500
25	G.E.	RC-32	800
25	Westg.	SK-133	975
20	Star	WB-16	1750
20	Westg.	SK-110	750
15	Westg.	SK-108	400/1000
10/15	Reliance	180T	400/1800

CHICAGO ELECTRIC

Carries a Complete Stock of New & Rebuilt Motors and Electrical Equipment. If what you need is not listed wire, write or phone giving particulars, or send for Stock list.

CHICAGO Electric Co. 1320 WEST CERMAK ROAD, CHICAGO 8, ILL.

STOP SEARCHING!

QUALITY and ECONOMY are quickly found in

HEMPHILL *Guaranteed* EQUIPMENT

NEW COMPLETE OUTDOOR SUBSTATION

2—3750 KVA, G.E. type OA, 4687 KVA forced air, 26400 volts pri., 3 taps above and below, 4350/2520 volts sec. with fans, steel structure, outdoor, 1-million KVA interrupting breaker, etc. Purchased 1951, never used.

TRANSFORMERS 60 CYCLE

Qu	KVA	Make	Type	PH.	Voltages
2	3750	G.E. New	OISC	3	26400x4160
1	1000	G.E.	Auto	2	4150x2400
1	1000	Amer.	OISC	2	4150x480
1	750	G.E.	HT	3	4150x120/240
2	750	G.E.	H	1	4600x120/240
1	500	Kuhl	OISC	1	4600x2300
1	400	Pitts.	OISC	1	4150x240/480
1	333	G.E.	H	1	13200x220/440
1	200	G.E.	HT	2	2400x240
1	200	G.E.	H	2	4150x2400Y
2	150	Pitts.	ODSC	1	2300x115/230
1	50	Whse.	S	1	2400x120/240
1	50	Amer.	OISC	1	13200x220/440
1	50	G.E.	H	1	2300x110/220
1	50	Amer.	AT	1	220x220/440
1	37½	Amer.	RS	1	6900x220/440
2	37½	G.E.	H	1	2400x120/240
1	37½	G.E.	H	1	13800x230/460
3	25	Niagara	OISC	1	4160Yx480
1	25	Maloney	HE	1	2300x115/220
1	25	Whse.	VR	1	2400x240/480
1	25	G.E.	H	1	11500x23460
1	10	Packard	A	1	650x110
1	10	G.E.	H	1	220/440x110/220

SQUIRREL CAGE MOTORS

H.P.	Make	Speed	Type	Volts
1—150	G.E.	720	KT	440
100	G.E.	1200	FTR	220/440
75	G.E.	1200	KF	220/440
75	G.E.	1800	K	440
75	Ideal	1200	AT	220/440
60	L.A.	1800	JXTEFC	220/440
40	G.E.	1200	KT	220

MOTOR GENERATOR SETS

Qu	KW	Make	Speed	DC	AC
1	1000	G.E.	514	600	2300/4150 3yn
1	1000	Whse.	720	600	2300/4150 3yn
1	1000	Whse.	720	275	2300/4150 3yn
1	300	G.E.	1200	250	2300/4150 SR
1	200	Whse.	900	250	2300/4150 3yn
1	250	C.W.	600	125	220/440 Y
1	100	G.E.	900	250	2300 3yn
3	97	G.E.	1200	60	4150 3yn
1	75	G.E.	1800	250	230/440 SC
1	60	Whse.	1200	60	2300 Y
2	60	EM	1200	125	230
1	30	Whse.	900	230	460
2	30	G.E.	1750	240	230/440
1	25	G.E.	1800	230	230 Y 3yn
1	20	EM	1800	125	230 Y
1	7½	Allis	1800	125	230/440
2	5	G.E.	1800	125	230/440
2	1½	G.E.	2850	200 cy 1 ph	230/440
1	5	Whse.	1800	125	220/440 V
2	3	G.E.	1800	250	220/440

SYNCHRONOUS MOTORS

QU	HP	Make	Speed	Type	Volts
1	500	Whse.	450	HR	2300
1	400	Whse.	450	HR	550
1	250	Whse.	450	HR	440
1	300	EM	720	TEFC	2300
1	300	G.E.	600	ATI	600
1	200	Whse.	600	ATI	240
1	175	G.E.	720	ATI	2300
3	150	G.E.	1200	TS	4150
1	150	G.E.	1800	TS	220
1	150	Whse.	900	TSIG	220
2	150	Allis	360		2300
1	125	EM	900		4600
1	100	G.E.	900	TS	2300

SLIP RING MOTORS

QU	HP	Make	Speed	Type	Volts
1	500	G.E.	1200	M	2400/6150
1	400	Whse.	450	CW	550
1	250	Whse.	60	CW	440
2	200	Whse.	600	CW	440
1	200	G.E.	600	MT	440
1	150	A.C.	1800	AT RW	2300
1	100	G.E.	1800	IM	220
1	100	G.E.	600	IM	440
1	75	G.E.	600	IM	440
3	60	G.E.	1800	MT	220
1	60	G.E.	900	MT 540	440
2	50	G.E.	1800	MT837	220/440
1	50	G.E.	1200	MT536	220/440
2	50	Whse.	900	CW	220/440
2	50	G.E.	600	MT	220/440

DC, 230 VOLT MOTORS

Qu	HP	Make	Speed	Type
1	300	G.E.	1200	MPC
2	150	C.W.	900	WP
1	125	G.E.	1700	BC
2	75	C.W.	900	WP
1	30	C.W.	700	CM
1	35	G.E.	850	BC
1	25	Whse.	835	BK

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FOR POWER

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BREW WOLTMAN *Offers—*

3500 KW 80% PF West. Cond. Turbo Gen.. 3-60-2400/4160 V., 3600 RPM 400 PSIG, 750° TT, dir. con. exciter, surf. cond. New 1948.

3000 KW 80% PF G.E. Cond. Turbo Gen. 3-60-2400/4160 V., 3600 RPM, 385 PSIG, 750° TT, dir. con. exciter, surf. cond.

4000 KW 80% PF G.E. Non-Cond., auto extr. Turbo Gen. 3-60-13800 V., 3600 RPM 600 PSIG 750° TT, 135# extr., 50# max. BP. NEW.

Full line power equipment—send us your inquiries.

BREW, WOLTMAN & CO., INC., 50 Church St., New York 7

MODERN DIESEL ENGINE AND GENERATOR

1000 Hp. Fairbanks-Morse Diesel Engine, Model 33-F-16, 5 cyl., 16"x20", 300 rpm., Woodward Governor, cooling system, pumps, starting equipment, direct connected to Fairbanks-Morse TGZO 860 KVA. Generator, A.C., exciter, generator panel, etc.

Purchased new 1947. Original foundation. Can be operated for inspection. Attractively priced.

DENNY & CLARK

824 W. Superior St. Chicago 22, Ill.

MOTORS!

Amt.	Hp.	Speed	Make	Type	Frame
1	200	900	A-C	AM836D	
1	150*	1800	Whse.	CS (2200V)	817S
1	150*	1800	A-C	26F-220-42-10	
3	150*	1800	A-C	AWW new	23H86
1	150*	900	G.E.	I-K (2200V)	
1	125	1700	Wag.	28WBP	
1	100	1800	Whse.	CS	663C
1	100	1200	Whse.	CS	782C
2	100*	1200	A-C	AR (2200V)	823E
1	100*	900	A-C	2K20064.1 (2200V)	
2	75	1800	C-W	SC (BB)	445S
1	75*	1200	A-C	(2200V) BB	423DS
1	75	900	Whse.	CS	725C
2	60	3600	L.A.	OGX BB	405S
1	60	1800	G.E.	KF BB Splash	584S
4	60	1200	Howill	BB	504
1	50	1720/575	L.A.	Adjusto-Speede	447
1	50	900	G.E.		584

*2200 Volts

SLIPRING!

1	100	900	G.E.	MT356	
1	100	720	Whse.	CW	
1	100	450	G.E.	I-M (2200V)	10
1	75	720	A-C	(2200V)	
2	75	900	G.E.	I-M	

PARTIAL LISTINGS—10,000 OTHER MOTORS IN STOCK—NEW & REBUILT—A.C. & D.C. NEW MOTORS AT LONG DISCOUNTS

BENSON-WILIMZIG, INC.

1704 North 8th Street

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DIESEL GENERATOR SETS

3—1400 HP Superior 8 cyl. 360 RPM 1000 KW Elec. Mchy. 3/60/2400 volt generators. Complete Plant. New 1949.

1—750 HP Superior 8 cylinder, 400 RPM, 500 KW Elec. Mchy. 3/60/2400 volt generator & auxiliaries.

1—400 HP Superior 4 cyl. 400 RPM Model VDSE, 250 KW, 3/60/2400 volt.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St. St. Louis 1, Mo.

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A.C. & D.C.

MOTORS AND GENERATORS

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1 YEAR GUARANTEE

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Phone: CAnal 6-6976

DIESEL GENERATOR SETS

1000 KW Diesel set, G.E., 3 Ph., 60 Cy., 2300 V., 300 RPM. Complete with Starting Equip. & switchboard.

200 KW G.M. Model 8-268A, 8 Cyl., 3/60/440 V., 1200 RPM. Inc. Panel & Accessories.

ALJON ELECTRIC DIESEL CO.

904 Pacific St. Brooklyn 38, N. Y.

STerling 3-6915

1—30 HP Erie City 200# Pressure Boiler
1—125 HP Locomotive Type 150# Boiler
1—15 HP Gas; 20 HP Oil Fired Boilers
1—5 Ton 46'7" Span OET Crane AC Mtrs.
1—250 & 200 HP 600 RPM Sq. Cage Mtrs.
1—DRXB & DFXD Hercules Diesels—A#1
1—6'7"x32' Annealing Furnace

H. & P., 6719 Etzel, St. Louis 14, Mo.

RE-NU-BILT
GUARANTEED

ELECTRIC POWER EQUIPMENT

D. C. MOTORS

Qu.	HP	Make	Type	Volts	RPM
1	3000	West.	Tandem	600	600
1	2200	G.E.	MCF	600	400/500
1	1400	G.E.	MCF	600	63/120
1	1200	G.E.	MCF	600	750/950
1	1000	G.E.	MCF	600	350/550
1	940	Whse.	QM	250	140/170
1	900	Whse.		250	450/550
1	825	Whse.		250	85/180
1	600	Al. Ch.		250	600/800
1	500	Whse.	CC-216	600	300/900
1	500	G.E.	MCF	250	300/900
2	450	Whse.		550	415
1	250	West.		250	840/950
1	200	Whse.	CB-511-3	250	400/800

A. C. MOTORS—3 Ph. 60 Cy.

SLIP RING

Qu.	H.P.	Make	Type	Volts	Speed
1	1500	G.E.	MT-498	2300	360
1	1500	ABB		2300	720
2	1000	A.C.	Mill	2300	240
1	500	G.E.	M-574Y	6900	900
1	500	Whse.	CW	550	350
1	450	G.E.	IM-17B	2300	705
1	400	Whse.	CW-960A	440	1170
1	400	Whse.	CW	440	514
1	400	Whse.	CW-1218	2200	435
1	350	G.E.	MT-442 Y	2200/4000	253
2	350	G.E.	IM-17A	440/2200	720
1	250	G.E.	MT-424-Y	4000	257
1	250	G.E.	MT-5595	2200	1800
1	250	Al.-Ch.		550	600

SQUIRREL CAGE

2	650	G.E.	FT-559BY	440	3570
2	450	Whse.	CS-1420	2300/4150	254
1	300	Whse.	CS	440	1170
1	200	G.E.	IK-17	440	580
3	200	G.E.	KT-557	440	1800
1	150	Whse.	CS-8568	440	880
1	150	Whse.	CS	440	580
1	150/75	G.E.	IK	440	900/1454
2	125	Al. Ch.	ARW	2200	1750

SYNCHRONOUS

1	4350	C.W.	2501-SL	13800/6900	514
2	2100	G.E.	ATI	2300	360
2	1750	G.E.	ATI	2300	3600
2	2000	Whse.		2300	120
2	735	G.E.	ATI	2200/12000	600
1	500	Ideal	SM	2300/4160	1800
1	500	Whse.		440	900
1	450	Whse.		2300	128.5
1	450	Whse.		2200	450
1	400	G.E.	TS	2200	400

M-G SETS—3 PH. 60 CY.

Qu.	K.W.	Make	RPM	DC Volts	AC Volts
2	2000/2400	G.E.	450	250/300	2300/4600
1	2000	G.E.	450	600	2300/4600
1	2000	G.E.	1000 25cy	600	11000
2	2000	G.E.	514	600	6600/13200
1	1750/2100	G.E.	514	250/300	4800/2400
1	1500	G.E.	720	600	6600/13200
1	1500	C.W.	514	30/115	4000/13000
3	1000	G.E.	720	600	2300/4600
1	1000	G.E.	900	260	2600
1	750	C.W.	514	30/115	2300
1	750	G.E.	900	125/250	2200
1	600	G.E.	720	250	440/2300
1	500	Whse.	1200	115/230	2300

TRANSFORMERS

Qu.	KVA	Make	Type	Ph.	Voltages
1	5000	Whse.	OISC	3	33000x26400
1	3000	Wagner	HPW-30	3	26400x2400
2	4200	G.E.-Fur.	FOWT	3	13800x200/87
3	2000	G.E.	HVDDJ	1	66000/13800
3	667	G.E.	HD	1	13800x2300
3	1000	G.E.	HVDDJ	1	2400x480
6	1000	Wagner	OISC	1	13200x460

FREQUENCY CHANGER SETS

Qu.	KW	Make	Freq.	Voltages
1	12500	Whse.	60/25	13200/13200
1	5000	G.E.	60/50/60	6600/11000/6600
1	3000	G.E.	60/25	2300/2300/4000
2	2500	G.E.	25/62.5	2300/2300
1	1000	G.E.	25/58.3	4400/2300
1	500	Al. Ch.	2500	11000/2300

TURBO GENERATORS

Qu.	KW	Make	Data.
1	4000	G.E.	Condensing 425—750 P.T.T. Surface Condenser 3/60/2300/4000 V Direct conn exciter.
1	1500	Whse.	Auto. extraction 190 lbs.—660° P.T.T. 60 lb. extraction 3/60/240 V. Div. conn. Exc.
1	1000	Moore	Auto-Ext. Cond. 175/200# I.S.P. 5/30# G. Ext. Surface Condenser—3/60/2300.
1	1000	G.E.	Non-condensing 175/205 lbs. I.S.P. 5/30 lbs. G.B.P., 480/3/60.
1	750	G.E.	Condensing 265# I.S.P. 440V. 3 ph. 60 cy.—New—1944.

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"Certified Rebuilt" Motors and Generators

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
350	Allis Ch. b.b.	EW	250	1000
200	Allis Ch. b.b.	EW	250	450
175	Whse.	SK	230	600
150	Whse.	SK-201	230	300/900
150	Whse.	SK-184	230	850
100	Whse.	SK-173	230	750
100	Reliance	651T	550	1000/1600
75	F. Morse b.b.	DH-140	115	1600
75	Whse.	SK170	230	635
50	G.E. dynam. (4)	TLC25	250	1800/3500
50	Reliance b.b.	851T	230	750
50	Whse.	SK185	230	300/900
40	Whse.	SK140	230	775
40	Gen. Elec.	BC32	550	1200
30	Imperial b.b.	D69	230	400/1600
30	Star b.b. (3)	SB	230	1750
25	Star b.b.	SB	230	1750
25	L. A. TEFC	RNA	230	850
25	Whse.	SK180	230	300/1200

MOTOR-GENERATOR SETS

KW	Mfr.	Input V	Output V
500	Whse.*	2300 AC	250 DC
300	Allis Ch.	2200/440 AC	125/250 DC
250	Allis Ch.	2300/440 AC	250 DC
200	Cr. Wheeler*	2300/4150 AC	250 DC
200	Whse.*	220/440 AC	55 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Whse.	2200/440 AC	275 DC
125	Gen. Elec.*	2300/4000 AC	250 DC
105	Century b.b.	220/440 AC	70 DC
100	G.E.*	2300/440 AC	125 DC
100	Whse.	220/440 AC	250 DC
75	F. Morse b.b.	220/440 AC	125/250 DC
75	Cent. b.b.	220/440 AC	125 DC
60	Gen. Elec.*	220/440 AC	60 DC
60	Whse (2)	220/440 AC	300 DC
50	Gen. Elec.	220/440 AC	125 DC
40	Gen. Elec.	220/440 AC	600 DC
30	Gen. Elec.	220/440 AC	250 DC
30	Gen. Elec. (2)	220/440 AC	125 DC
30	F. Morse b.b.	220/440 AC	24 DC
25	Whse.	220/440 AC	125 DC

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Al. Ch.	MEW	125/250	1200
250	Allis Ch. b.b.	EW	250	1200
175	Allis Ch. b.b.	SW	250	900
150	Gen. Elec. b.b.	CDM	250	1200
105	Century b.b.	1500 amp.	70	1200
100	Whse.	SK163	250	1200
100	Allis Ch.	E	125	1000
100	Reliance	651T	600	1200
75	Cent. b.b.	D199X	125	1150
75	F.M. b.b.	DH	125	1800
75	G.E. b.b. (2)	CDM135	125	750
75	Whse.	SK	250	900
60	Whse. b.b. (2)	SK121	300	1200
50	Whse.	SK150	250	1100
40	Whse.	SK140	250	1100
40	Gen. Elec.	BC32	600	1750
25	Whse.	SK93	125	1750
25	C.W. b.b. (2)	CCD	250	1200

A. C. MOTORS — 60 CYCLE

HP	Mfr.	Type	Volts	Speed
750	G.E.	Synch.	2200	514
700	Allis Ch.	Sq. Cage	440	900
500	Gen. Elec.	Sq. Cage	2200	3600
500	G.E.	Sq. Cage	4000	1800
500	G.E.	Slipring	2300/440	450
500	G.E.	Synch.	440	900
450	Allis Ch.	Synch.	480	450
400	Whse.	Sq. Cage	2200	514
400	G.E.	Synch.	440	450
350	Whse. (2)	Slipring	2300	450
300	G.E. (2)	Slipring	2300/440	720
300	El. Machy	Synch.	220/440	360
300	Al. Ch.	Sq. Cage	2300/440	720
300	Whse.	Synch.	2300/440	600
300	G.E.	Slipring	440	900
250	Gen. Elec.	Synch.	220/440	450
250	F. Morse b.b.	Slipring	440	600
250	Whse. (2)	Sq. Cage	2200/440	1200
250	L.A. (2)	Sq. Cage	2200	1800
225	G.E.	Synch.	220/440	900
200	Gen. Elec.	Sq. Cage	220/440	1200
200	F. Morse b.b.	Slipring	220/440	600
200	Reliance b.b.	Sq. Cage	220/440	1800
200	Allis Ch.	Slipring	440	450
200	Gen. Elec.	Sq. Cage	2300/440	720
200	Cr. Wh.	Sq. Cage	220/440	3600
200	Whse.	Sq. Cage	2200/440	900
200	E. M.	Synch.	220/440	1200
200	E. M.	Synch.	220/440	514
175	G.E. (2)	Synch.	220/440	720
175	Whse.	Synch.	220/440	360
150	Whse.	Sq. Cage	220/440	900
150	G.E.	Synch.	220/440	450
150	Allis Ch.	Slipring	2200/440	720
150	G.E. (2)	Sq. Cage	2200/440	720
150	Allis Ch.	Sq. Cage	2200/440	1200
150	Rel. b.b.	Sq. Cage	220/440	1800
150	Allis Ch.	Sq. Cage	440	450
150	G.E. vertical	Slipring	4000/2300	1200
125	G.E. TEFC	Sq. Cage	220/440	3600
125	Whse.	Sq. Cage	220/440	900
125	Rel. TEFC	Sq. Cage	220/440	1800
125	G.E.	Slipring	220/440	450
125	E. M.	Synch.	220/440	1800
125	Allis Ch.	Slipring	220/440	900
100	G.E.	Slipring	220/440	514
100	G.E.	Slipring	220/440	900

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn cond		4000/2300	300
625	Gen. Elec.	ATB	2300	450
600	Gen. Elec.	ATB	480	900
485	Allis Ch.	1 brg.	480	400
312	Gen. Elec.	ATB	240/480	600
275	G. E. 25 cycle	ATI	480	750
250	El. Machy.		480	720
235	Gen. Elec.	ATI	240/480	900
150	Gen. Elec.	ATB	2300	900
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
75	El. Machy.		2300	900
50	G. E.	ATB	240/480	1200

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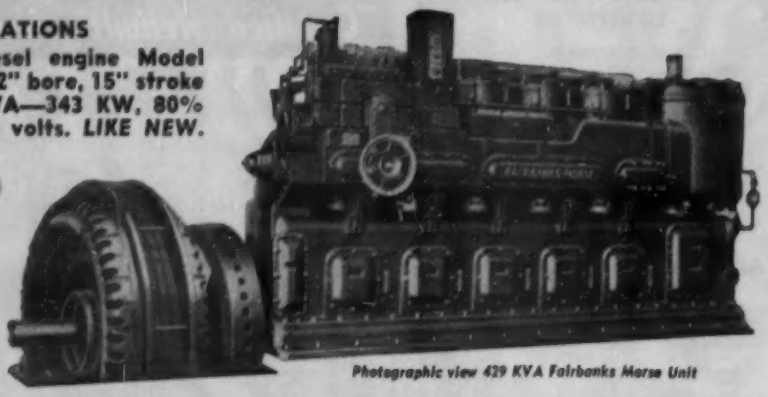

Photographic view 429 KVA Fairbanks Morse Unit

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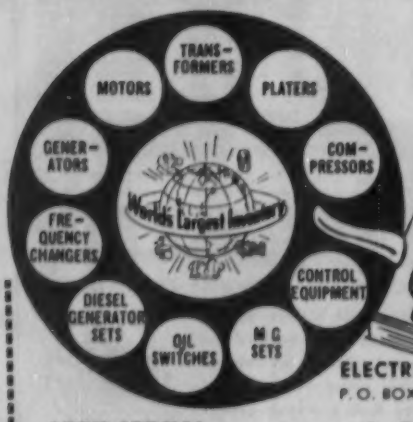

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48.6 CFM	3500 psi	3 stage Ingersoll 25 HP Elec	
122 CFM	100 psi	American 20 HP Elec	
125 CFM	100 psi	6½x4½ Davey VB9-6 Available	
142 CFM	125 psi	6/6/5x5 Ingersoll Type 40—25 Elec	
211 CFM	100 psi	9½x9 American 40 HP Elec	
254 CFM	100 psi	10x10 Ingersoll ER-1 40 HP Elec	
258 CFM	500 psi	10/4½x10 Ingersoll 75 HP Synch	
276 CFM	125 psi	2 stage Chicago PB-50 HP Elec	
285 CFM	125 psi	2 stage Gardner "WB" 50 HP	
291 CFM	40 psi	5 cylinder Ingersoll Type 40	
294 CFM	100 psi	10x11 Ingersoll ER-1 50 HP Elec	
343 CFM	500 psi	11/5x13 Worth Elec or steam	
353 CFM	100 psi	12½x10 American WTR 60 HP Elec	
364 CFM	20 psi	12x7 Gardner "RX" 2 available	
426 CFM	100 psi	12x11 Ingersoll ES-1 NL—Oil-less	
462 CFM	100 psi	12x11 Ingersoll ES-175 HP Elec	
460 CFM	125 psi	13/9x10 Ingersoll XRB—Duplex	
510 CFM	125 psi	13/9x12 Ingersoll XRB—Duplex	
676 CFM	125 psi	15/9½x12 Ingersoll XRD—Duplex	
861 CFM	30 psi	17x11 Ingersoll ES-1	
931 CFM	55 psi	17x13 CPT Elec or steam	
1085 CFM	35 psi	20x12 Penn-3A 100 HP Elec	
1292 CFM	35 psi	20x13 Chicago T-S 125 HP Elec	
1574 CFM	50 psi	15/15x14 Penn DB-1 200 HP Elec	
1723 CFM	110 psi	"XPV" 4 corner Ingersoll steam	

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Qty.	HP	Make	Voltage	Speed
19	2000	West.	525/600	600 RPM
26	1500	West.	525/600	600 RPM
93	1500	Al. Ch.	525/600	675 RPM
4	1300	Al. Ch.	525/600	650 RPM
2	900	Elliott	250	500/195 RPM
3	2000	West.	525/600/2000	RPM
1	850	Cr. Wh.	230	475/720 RPM
1	500	West.	230	250/500 RPM
1	450	West.	250	600/1200 RPM
1	600	G.E.	230	180/360 RPM
7	400	Elliott (new)	230	400/800 RPM
5	400	West. (new)	230	375/750 RPM
1	250	Cr. Wh.	230	450/900 RPM
1	500	Cr. Wh.	230	500/750 RPM
1	500	Cr. Wh.	230	375/750 RPM

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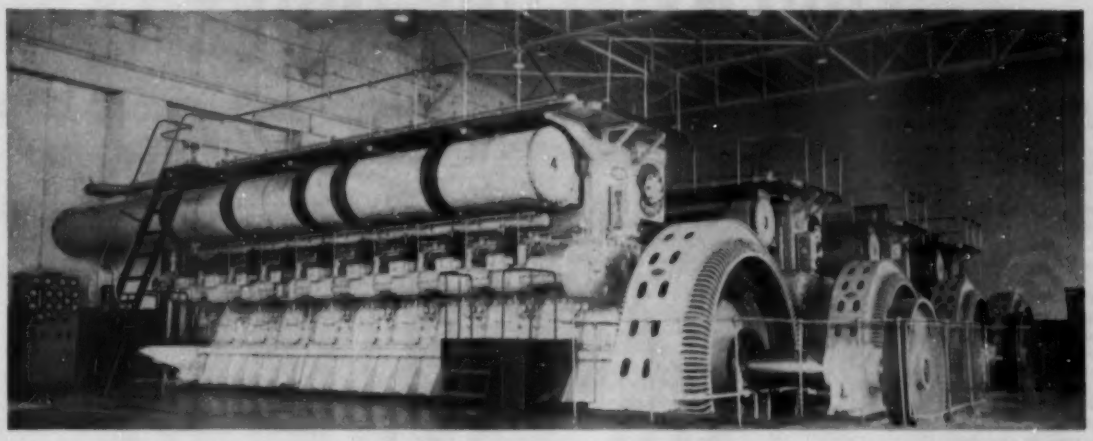

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ADVERTISERS' INDEX

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Adams Co., Inc., R. P. 273
Air Preheater Corp. 211
Allen-Sherman-Hoff Co. .....Second Cover
Allis-Chalmers Mfg. Co. 30-31, 37, 63, 69, 167
Allpax Company Inc. 226
Alpha Corporation ..... •
American Blower Corp. 22-23
American Engineering Co. ..... •
American Gilsonite Co. 259
American Locomotive Co. (Alco Products Div.) ..... •
American Pulverizer Co. 182
Ames Iron Works, Inc. ..... •
Anchor Packing Co. 68
Arkansas Fuel Oil Co. 199
Armstrong Cork Co. 189
Armstrong Machine Works 145
Automatic Control Co. ..... •

Babbitt Steam Specialty Co. 234
Babcock & Wilcox Co. 6-7
Babcock & Wilcox Co. (Fittings Dept.) ..... •
Babcock & Wilcox Co. (Tubular Prods. Div.) 233
Badger Mfg. Co. 245
Bailey Meter Co. 12-13
Baldwin-Hill Co. ..... •
Baltimore & Ohio Railroad 190
Barber-Colman Co. ..... •
Beico Industrial Equip. Div. Inc. ..... •
Bell & Gossett Co. 219
Belmont Packing & Rubber Co. 194
Bergen Pipesupport Corp. ..... •
Bets Co., W. H. & L. D. 142
Biddle Co., James G. ..... •
B-I-F Industries, Inc. 170, 210
Black, Sivalls & Bryson, Inc. 201
Blackmer Pump Co. ..... •
Blaw-Knox Company 184, 213
Boiler Engrg. & Supply Co., Inc. ..... •
Boiler Tube Co. of America ..... •
Bridgeport Brass Co. 249
Broo Boiler & Mfg. Co., Wm. ..... •
Brown Fintube Co. 229
Buell Engineering Co. 202
Buffalo Forge Co. 52
Buffalo Pumps, Inc. ..... •
Builders-Providence, Inc. 170, 210
Bussmann Mfg. Co. 72-73
Byron Jackson Company 195

Carey Mfg. Co., Philip ..... •
Cash Co., A. W. 169
Catawissa Valve & Fittings Co. ..... •
Chapman Valve Mfg. Co. 179
Chase Brass & Copper Co. 271
Chesterton Co., A. W. 214
Chicago Pneumatic Tool Co. 288
Childers Mfg. Co. ..... •
Cities Service Oil Co. 199
Clarage Fan Co. 36

Clark Bros. Co. ..... •
Cleaver-Brooks Co. (Boiler Div.) 221
Cochrane Corporation 70
Coffin, Jr. Co., J. S. ..... •
Combustion Control Div. Electronics Corp. of America ..... •
Combustion Engineering, Inc. 38-39
Condenser Service & Engrg. Co. Inc. 196
Cooper-Bessemer Corp. 264
Copes-Vulcan Div., Continental Foundry & Mach. Co. 14-15
Coppus Engineering Corp. 161
Corning Glass Works 216
Crane Company 4, 162
Crane Packing Co. ..... •
Crawford Fitting Co. ..... •
Cyclotherm Corporation 236

Dart Union Co. 188
Dearborn Chemical Co. 40-41
DeLaval Separator Co. ..... •
DeLaval Steam Turbine Co. 2, 46-47
Deming Company ..... •
Denison Engineering Co. ..... •
Detroit Stoker Co. 268
Diamond Power Specialty Corp. 8-9
Dodge Mfg. Corp. ..... •
Dowell, Inc. ..... •
Drave Corporation 240
Drew & Co., Inc., E. F. 215
Durabla Mfg. Co. ..... •

Eagle Picher Co. 110
Edison, Inc., Thomas A. 228
Edward Valves, Inc. 42-43
Electric Machy. Mfg. Co. ..... •
Elgin-Refinite Div. of Elgin Softener Corp. ..... •
Elliott Company 16-17
Ellison Draft Gage Co., Inc. ..... •
Engineer Company 150
Erico Products, Inc. 65
Erie City Iron Works 32
Ernst Water Column & Gage Co. 240, 277
Everlasting Valve Co. 192

Felt Products Mfg. Co. ..... •
Fisher Governor Co. 185
Flexitallic Gasket Co. ..... •
Foster Engineering Co. 222
Foster Wheeler Corp. 28-29
Foxboro Co. ..... •
Frick Company 222
Fuller Company 256

Garlock Packing Co. 269
General Cable Corp. ..... •
General Electric Co. (Apparatus Dept.) 51

Goulds Pumps, Inc. 246
Graver Water Conditioning Co. 275
Green Fire Brick Co., A. P. 187
Greene, Tweed & Co. ..... •
Grinnell Company .....Third Cover
Griscom-Russell Co. ..... •
Gulf Oil Corporation ..... •

Hagan Corporation ..... •
Hall Laboratories 183
Halstead & Mitchell ..... •
Hankinson Corporation ..... •
Harbison-Walker Refractories Co. ..... •
Hays Corporation 265
Hewitt-Robins, Inc. ..... •
Heyl-Patterson, Inc. 55
Hill Pump Valve Co. ..... •
Hills-McCanna Co. 224
Hoffman Specialty Mfg. Corp. ..... •

I-T-E Circuit Breaker Co., Switchgear Div. 197
Illinois Water Treatment Co. ..... •
Infilco Inc. ..... •
Ingersoll-Rand Co. 24-25
International Nickel Co. 266
Iron Fireman Mfg. Co. ..... •
Irving Subway Grating Co., Inc. 226

Jeffrey Mfg. Co. 269
Jenkins Bros. 149
Jerguson Gage & Valve Co. ..... •
Jahns-Manville 62, 159
Johnson-March Corp. ..... •
Johnson Service Co. ..... •
Joy Mfg. Company 64

Kaiser Engineers Div. of Henry J. Kaiser Co. 58
Kate Engrg. Company ..... •
Keasbey & Mattison Co. 252
Keckley Co., O. C. 248
Kennedy Van Saun Mfg. & Engrg. Corp. .. •
Kewanee-Ross Corp. 67, 241
Key Company 232
Klinger Ltd., Richard 175
Klöckner-Humboldt-Deutz, A/G Köln R/H, Germany 274
Koppers Co., Inc. (Coupling Dept.) 57
Koppers Co., Inc. (Engrg. & Const. Div.) 237
Kuljian Corporation ..... •

Laclede Stoker Co. 178
Ladish Company 34-35
Layne & Bowler Pump Co. 204
Leeds & Northrup Co. ..... •
Leslie Company ..... •
Link-Belt Co. 1

Lockett & Co., Ltd., A. M. ..... •
Lunkenheimer Company ..... •

Mahon Co., R. C. ..... •
Manning, Maxwell & Moore, Inc. 54, 239
Marley Company ..... •
Marsh Instrument Co. ..... •
Mason-Neilan Regulator Co. 253
McAlear Mfg. Co. ..... •
McDonnell & Miller, Inc. 274
McGraw-Hill Book Co. ..... •
McKiernan-Terry Corporation ..... •
Mears-Kane-Ofeldt, Inc. 234
Mercoid Corporation 212
Mesta Machine Co. 66
Midcontinent Tube Service, Inc. 277
Midwest Piping Co., Inc. ..... •
Milton Roy Company 50
Mine Safety Appliance Co. ..... •
Minneapolis-Honeywell Reg. Co. Industrial Div. 48-49
Mundet Cork Corp. ..... •
Murray Iron Works Co. 198, 225
Murray Mfg. Co., D. J. 212

National Airoil Burner Co., Inc. 232
National Aluminate Corp. 151
National Coal Association 61
National Tube Co. ..... •
National Valve & Mfg. Co. 235
Niagara Blower Co. 218
Nicholson & Co., W. H. ..... •
Nordberg Mfg. Co. ..... •
North American Mogul Products Co..... 234
Norton Company 141

Ohio Brass Co. ..... •
Ohio Injector Co. 157
Orr & Sembower, Inc. ..... •
Owens-Corning Fiberglas Corp. 269

Panalarm Products, Inc. ..... •
Panellit, Inc. ..... •
Pennsylvania Flexible Metallic Tubing Co., Inc. 269
Pennsylvania Pump & Compressor Co..... •
Permutit Company .....Back Cover
Perolin Co., Inc. 257
Petro ..... •
Philadelphia Gear Works, Inc. 251
Philadelphia Pump & Machy. Co., Inc.... 238
Phoenix Mfg. Co. (Flange Div.) ..... •
Pittsburgh Piping & Equipment Co. 74
Powell Co., Wm. 231
Powers Regulator Co. 135
Pratt Co., Henry ..... •
Preferred Utilities Mfg. Corp. ..... •
Pritchard & Co., J. F. 193, 261
Proportioneers, Inc. ..... •
Pure Oil Company ..... •

Raybestos-Manhattan, Inc. Manhattan Rubber Div. ..... •
Raybestos-Manhattan, Inc. Packing Div. 206
Ray-O-Vac Company ..... •
Refractory & Insulation Corp. 244
Republic Flow Meters Co. 20-21
Republic Steel Corp. 18-19
Research-Cottrell, Inc. 262
Revere Copper & Brass, Inc. ..... •
Ric-Wil Incorporated ..... •
Ridge Tool Co. 196
Riley Stoker Corporation 108-109
Rohm & Haas Co. (Resinous Prod. Div.) ..... •
Roto Div. of Elliott Co. 230

Sarco Company 155
Schaub Engrg. Co., Fred H. ..... •
Scovill Mfg. Co. 260
Seter Engineering Corp. ..... •
Shell Oil Co. 191
Sinclair Refining Co. 227
Smith Corporation, A. O. ..... •
Socony-Vacuum Oil Co., Inc. 177
Sparkler Mfg. Co. ..... •
Spence Engineering Co. 265
Springfield Boiler Co. ..... •
Standard Oil Co. of Indiana 59
Stephens-Adamson Mfg. Co. ..... •
Stickle Steam Specialties Co. 242
Stock Equipment Co. 243
Stockham Valve & Fittings 217
Stone & Webster Engrg. Co. 53
Strong, Carlisle & Hammond Co. ..... •
Superior Combustion Industries 173

Taylor Instrument Co's. 258
Taylor & Co., W. A. 240
Tennessee Corporation ..... •
Terry Steam Turbine Co. 263
Texas Company ..... •
Tube-Turns, Inc. 207-208

Union Asbestos & Rubber Co. 33
Union Iron Works ..... •
United States Gasket Co. 176
United States Gauge (Div. of American Machine & Metals, Inc.) 254
United States Rubber Co. (Mechanical Goods Div.) 56, 181
U. S. Steel Corp. ..... •

Van Der Horst Corporation ..... •
Viking Pump Co. ..... •
Virginia Gear & Machine Corp. 251
Vogt Machine Co., Henry 267

Wallace & Tiernan Co., Inc. 220
Walworth Company 247
Warren Steam Pump Co., Inc. 250
Watson-Stillman Fittings Div. ..... •
Western Chemical Co. ..... •
Western Precipitation Corp. 270
Westinghouse Electric Corp.....10-11, 44-45
Westinghouse Electric Corp. (Sturtevant Div.) 147
Wheeler Mfg. Co., C. H. 152-153
Where to Buy 277
Wickes Boiler Company 165
Wiedeke Co., Gustav ..... •
Wiegand Co., Edwin L. (Ind. Div.) 216
Wilson, Inc., Thomas C. ..... •
Wing Mfg. Co., L. J. ..... •
Worthington Corporation 60

Yarnall-Waring Company 26-27, 137
Youngstown Sheet & Tube Co. 255

Zallea Bros. ..... •

Professional Services **277**

SEARCHLIGHT SECTION

(Classified Advertising)

H. E. Hilty, Mgr.

EMPLOYMENT
Positions Vacant 277, 278
Selling Opportunities Offered 278
Positions Wanted 278
Selling Opportunities Wanted 278
EDUCATIONAL 278
EQUIPMENT
(Used or Surplus New)
For Sale 278-285
WANTED
Equipment 283
ADVERTISERS INDEX
Aljon Electric Diesel Co. 282
American Air Compressor Corp. 284
Anheuser-Busch Inc. 285
Belyea Co., Inc. 283
Benson-Wilimzig Inc. 282
Board of School Commissioners 284
Boston Metals Co., Inc. 285
Brackett Co., W. H. 285
Brew, Woltman & Co., Inc. 282
Chicago Electric Co. 281
Denny & Clark 282
DeRose, G. M. 278
Ebasco Services Inc. 278
Electric Equipment Co. 284
Electric Service Co., Inc. 283
Hall & Co., Stephen 278
Heat & Power Co., Inc. 285
Hemphill & Co., Inc. 282
H & P Machinery Co. 282
Hoover Co. 278
Howe Brothers 278
Hunt Foods of Ohio Inc. 278
Johnson & Assoc., H. Blaine 284
Land, L. J. 282
Mississippi Valley Equipment Co. 282
Neuman & Co., Inc. 278
O'Brien Machinery Co. 280
Power Plant Equipment Co., Inc. 285
Rearick, Charles B. 285
Schoonmaker Co., Inc., A. G. 281, 284
Utilities Machinery Corp. 279, 284
Wagner Co., Arthur 283
Walker & Collins 278
Weaver, Charles 280

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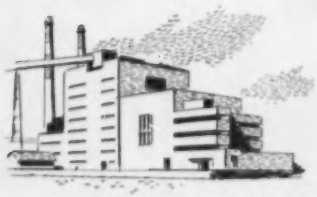

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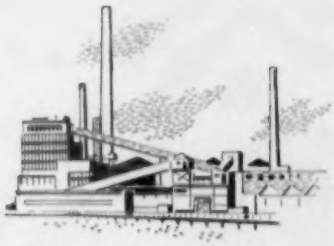

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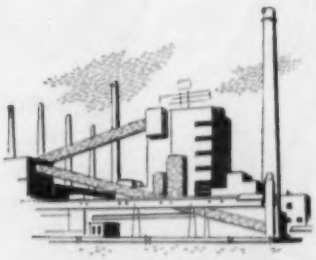

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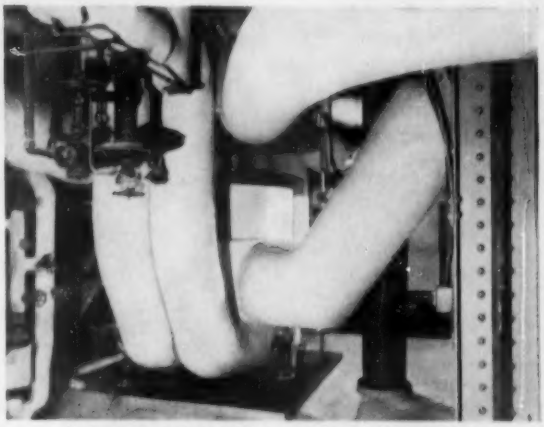

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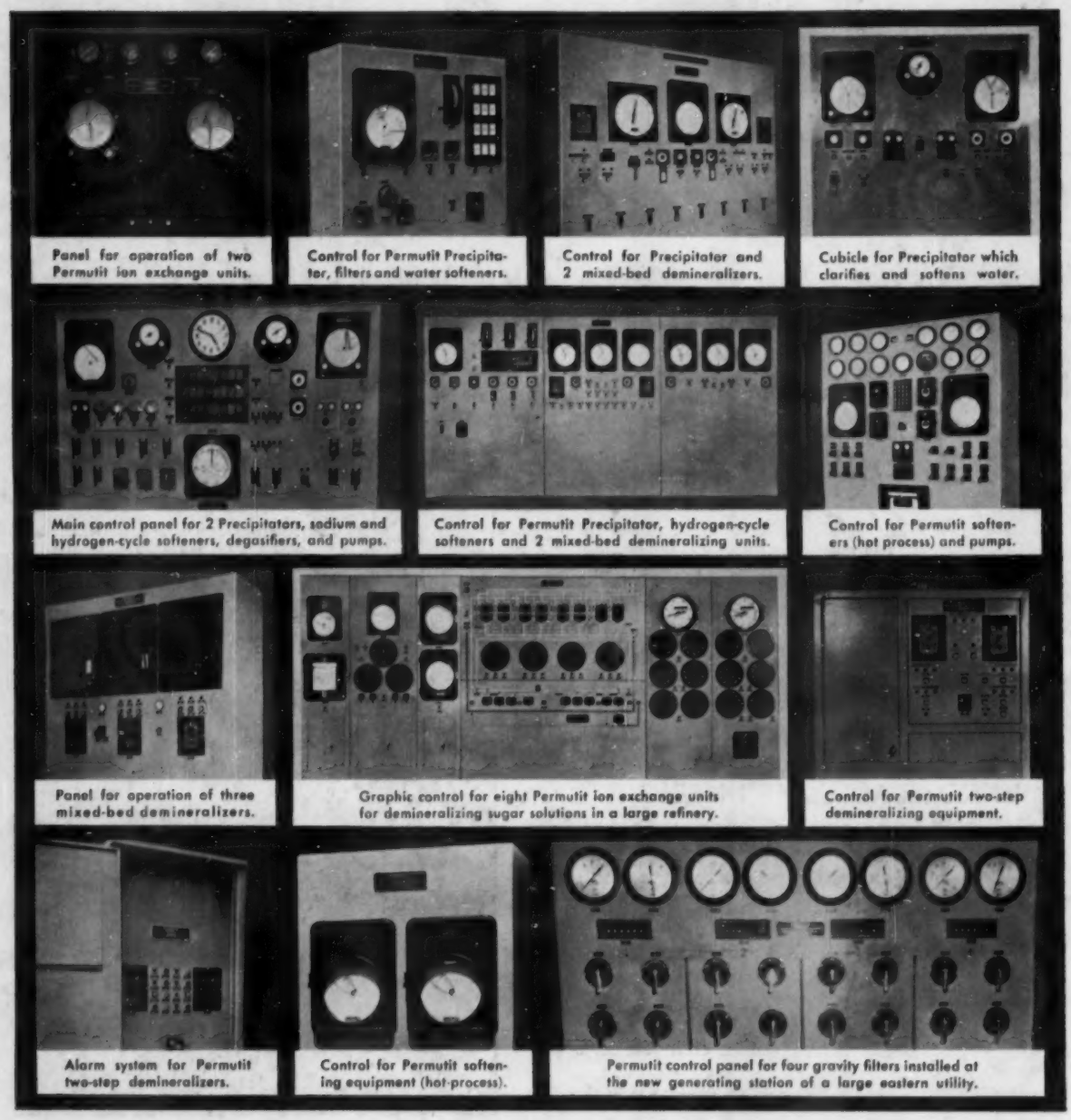

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